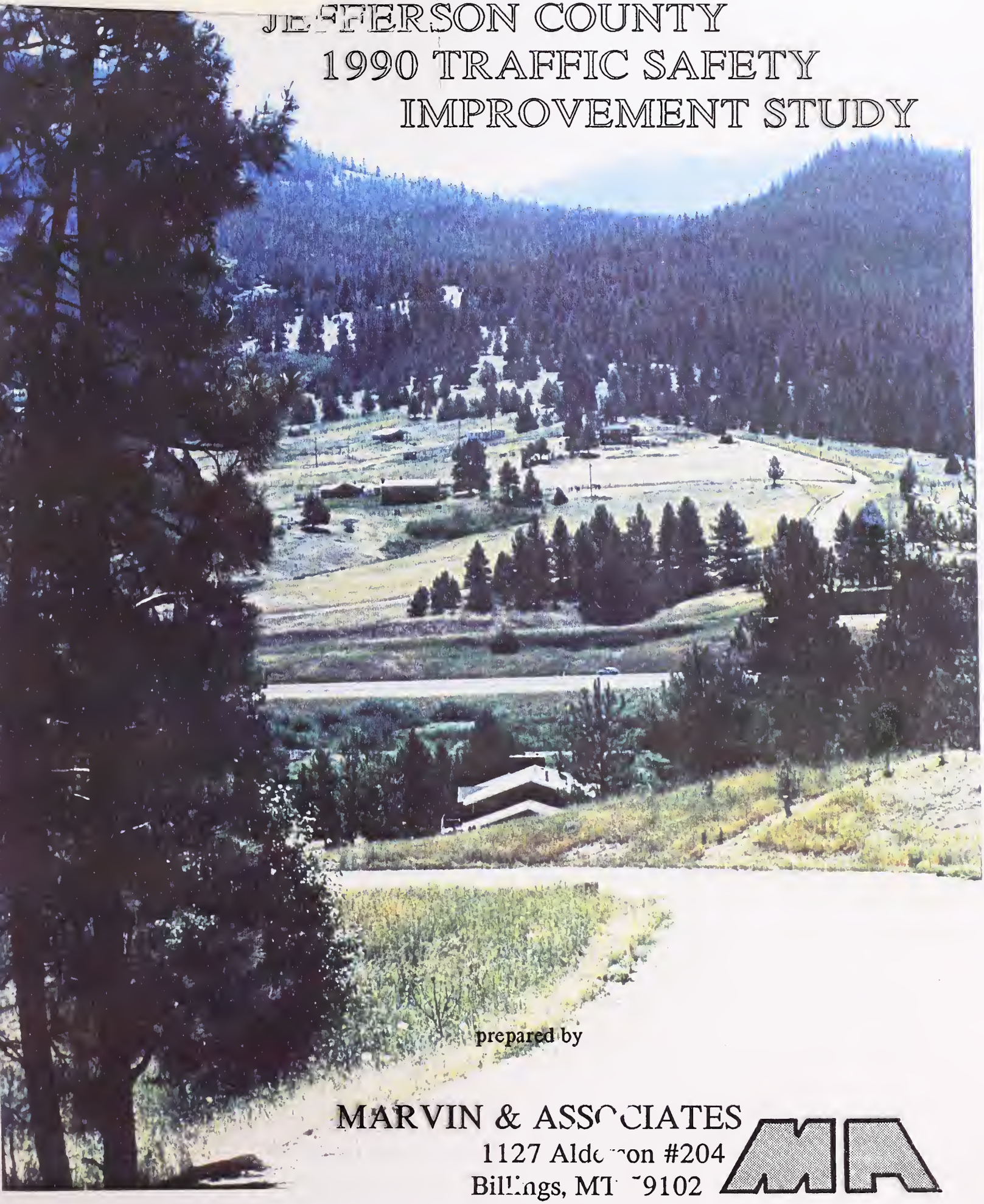
JEFFERSON COUNTY
1990 TRAFFIC SAFETY IMPROVEMENT STUDY



prepared by

MARVIN & ASSOCIATES
1127 Alderson #204
Billings, MT 59102

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TRAFFIC SAFETY

IMPROVEMENT STUDY

PREPARED FOR

JEFFERSON COUNTY
COMISSIONERS

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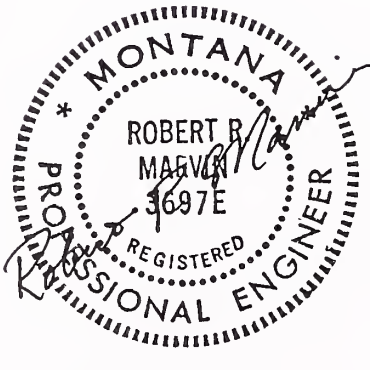
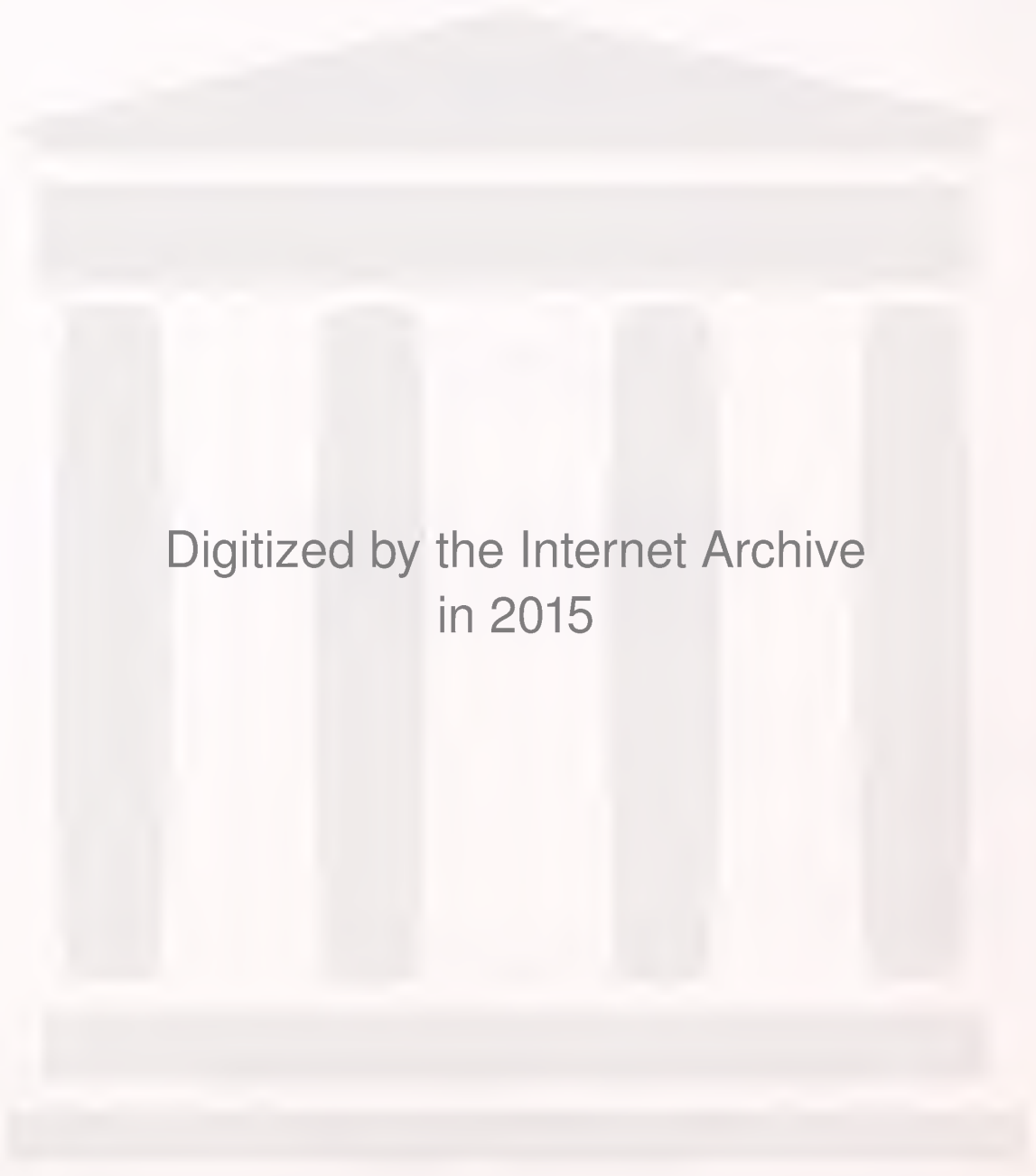
MARVIN & ASSOCIATES
1127 ALDERSON AVE. #204
BILLINGS, MT 59102



SEPTEMBER, 1990



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INTRODUCTION

STUDY PURPOSE

Jefferson County, in an effort to reduce or otherwise alleviate problems at accident cluster sites on the County Road System, had retained the Consulting Engineering Firm of Marvin & Associates to perform a traffic engineering study. The purpose of this study was to identify accident cluster locations, collect and analyze pertinent data, make short and long term safety improvement recommendations and establish a priority list of improvement projects.

Other similar studies have been completed for Montana counties with the technical and fiscal assistance of the Montana Department of Justice, Highway Traffic Safety Division. The intent of the Highway Traffic Safety Division in sponsoring these studies is to first, reduce accidents on the county road systems and secondly, to establish an awareness of accident reduction measures so that a continuation of the program can be established within each county.

The methodology used in these studies, which primarily served as the basis for the analysis within this report, can be found in the report *No. FHWA-RD-77-83 "Identification of Hazardous Locations"*. Refinements to the FHWA report made by *DCA Project No. 79-04-01-01* and subsequent county studies throughout the state, are also incorporated within this report. The methodology used to establish priority rankings is explained in the Benefit/Cost Ratio section of this report and is tailored specifically to Jefferson County's unique requirements.

The implementation of traffic safety improvements contained within this report is presented differently than in some previous studies. Since the Montana Department of Highways (MDOH) has Off-system Safety funds available for use on some or all of the improvement projects recommended herein, the priorities and funding obligations are specifically tailored to MDOH requirements. Upon approval of this program by the county commission, this report should be submitted to the Department of Highways as justification for Off-system Safety fund allotments.

REPORT ORGANIZATION

The initial section of this report contains narratives describing the accident cluster site locations, characteristics of the county road system, study methodology, results of the hazard index analysis for all of the sites, explanation of the improvements recommended, priority index calculations, an implementation schedule and recommendations for continuation of the program in future years. **Special attention should be given to the Site Characteristics and Explanation of Improvements sections, since specific traffic safety information for the Jefferson County road system is presented in these sections.**

Site specific data can be found within the individual site sections following the main body of this report. A great deal of computer generated data was printed and reduced for inclusion on the existing condition and short term improvement sketches. The availability of pertinent data on the same page as the sketches hopefully aids in comprehension of the problem identification and improvement benefits. The short term plan sketches can also be used by the Department of Highways to verify the traffic control device items eligible for funding through their program.

The site specific sections of this report are numbered according to their priority ranking as indicated in the site location section of this report. Ten sites are included in this project as per the contract budget. Some of the sites were extensive in length and encompassed several localized cluster sites within them. For these particular sites, the recommendations are tied to improving individual sections with safety of the entire corridor in mind.

The basic organizational format of the site specific sections is as follows:

Narratives:	Location Description
	Existing Conditions
	Geometrics
	Traffic Control Devices
	Traffic Volumes
	Traffic Operations
	Accidents
	Short & Long Term Improvements
	Benefits
Figures:	Photos
	Existing Condition Sketch
	Short Term Improvement Sketch

SITE CHARACTERISTICS

SITE LOCATIONS

The maps contained at the end of this section (Figures 1.) show the ten accident sites and corridor areas respective to their priority numbers. Table 1., below, is a listing of site numbers corresponding to the site locations:

TABLE 1. LIST OF STUDY SITES

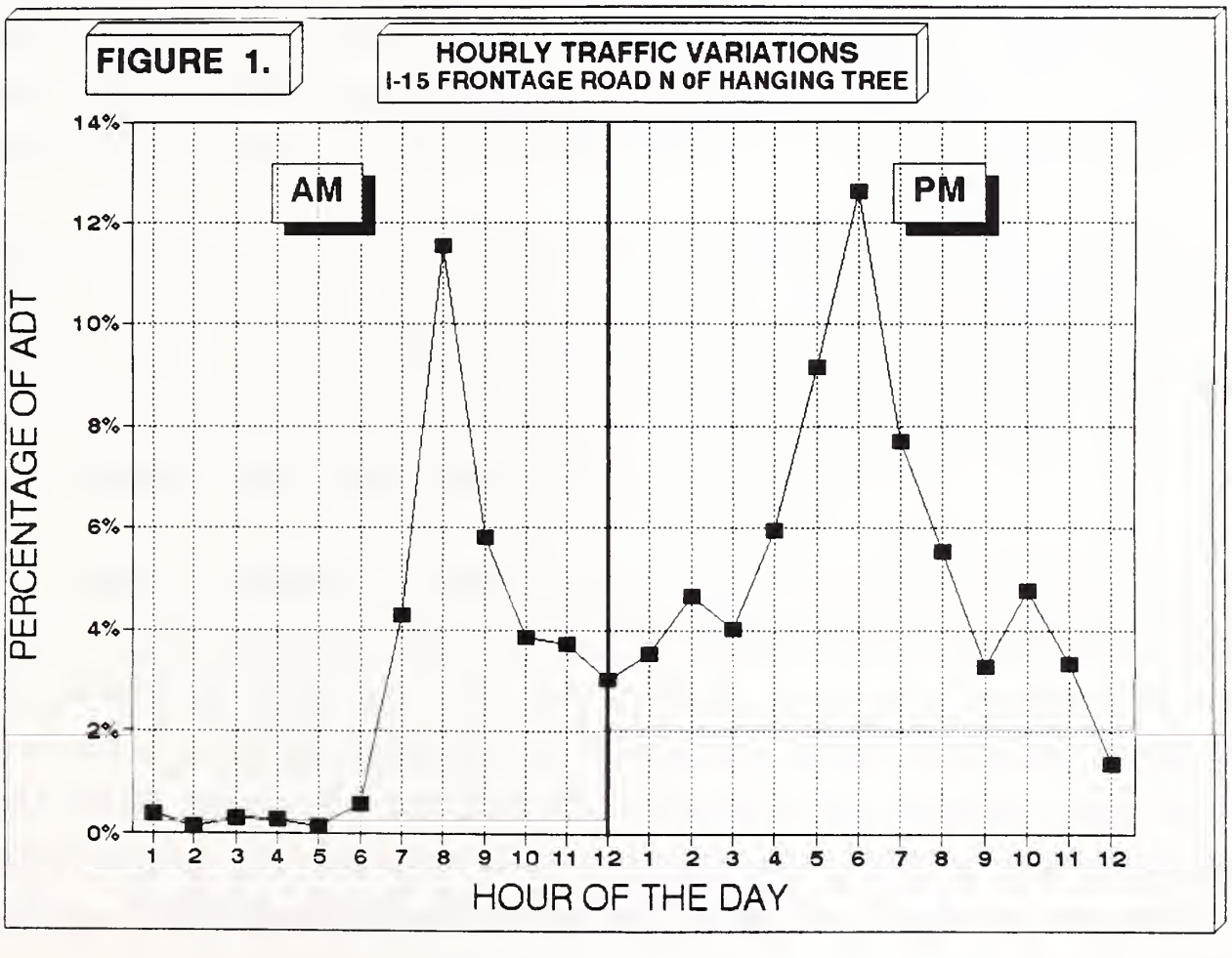
SITE NO.	SITE LOCATION
1	SADDLE MOUNTAIN ROAD
2	I-15 FRTG. RD - HANGING TREE LN
3	CLANCY CREEK ROAD
4	WARM SPRINGS CREEK ROAD
5	PIEDMONT ROAD - KOUNTZ ROAD
6	FOREST PARK ROAD
7	LUMP GULCH ROAD, 4 MILE
8	LUMP GULCH, CLANCY FRONTAGE
9	McCLELLAN ROAD
10	CORBIN - WICKES ROAD

SYSTEM CHARACTERISTICS

Traffic Volumes - All of the accident sites are located in a rural environment and are on low volume roads. The highest traffic volume at any site is approximately 1,600 vehicles per day while the lowest volume is approximately 200 vehicles per day or 200 ADT (Average Daily Traffic).

Montana Department of Highways provided information on historical traffic volumes for various county road sections. Traffic volume counts provided by MDOH were recorded on machine counters. These counts were used to determine hourly traffic variations on various types of roads in Jefferson County. The hourly counts were

graphed as a percentage of average daily traffic verses hour of the day. Figure 2. is the hourly traffic variation plots for the I-15 Frontage Road north of Hanging Tree Lane. This road is typical of most all the roads encountered in this study. It is evident from the graph that this is a commuter type road, since there is an extreme peak in the morning and afternoon. The evening peak hour is the highest volume percentage of any hour of the day and is approximately 12-13% of average daily traffic. The morning peak hour is the second highest peak of the day with 11% to 12% of average daily traffic.



Roadway Characteristics - The Jefferson County Road System contains roads typical of rural western Montana. Paved roads are found mostly in areas of higher density populations and dirt and gravel roads usually serve areas with sparse population. Generally, roadway surface types increase in quality as traffic volumes increase. There are some exceptions in Jefferson County. Specifically, Forest Park Road is a gravel road and it has the third highest traffic volumes of all accident sites. Some of the other sites have a better quality road surface than this road.

One common practise of Jefferson County seems to be construction of an interim pavement surface using fine gravel and an application of double penetration asphalt. This type of road surface provides a smooth uniform surface on a temporary basis but, it has a very short life span. Constant maintenance is required to preserve the riding integrity of this type surface. When it deteriorates, it usually spalls off in large chunks which creates potholes. The potholes then become an obstacle to avoid, causing drivers to veer from their direction of travel in an errant manner.

Gravel roads are not as susceptible to spalling, but they tend to develop small ridges or a washboard type surface, usually in areas of acceleration (hills and curves). The washboard road is a common condition at all Jefferson County sites that have a gravel surface. This type of condition causes a vehicle to loose control at various speeds, depending on the type of vehicle.

Road surface conditions can play a major role in the safety of streets and highways. A large number of Jefferson County accidents were attributed to washboard conditions or loose gravel. There are probably many more accidents that could have had road surface conditions as a secondary factor contributing to the event. Even though most of the proposed improvements in this document relate to traffic control devices, the roadway surface is a prime factor in driver expectancy and as such, it should be maintained to provide a reasonable degree of consistency.

Another of the most common problems observed at the study sites, involved condition of the roadside environment ie. sight distance restrictions caused by trees and brush or by machinery, buildings and fences within in the intersection sight triangle. Trees should be trimmed at least 10 feet above the roadway and bushes should

not exceed 3 feet in height to provide an unobstructed line of sight. In the forested section of roadway, clearing of trees is sometimes impractical, but critical obstructions could still be removed without a massive effort. Proper stopping and intersection sight distances for any individual section of road can be calculated by using the AASHTO "Policy On Geometric Design for Highways and Streets", commonly known as the"Green Book".

Traffic Control Devices - Some degree of traffic control devices were present at almost all of the sites. However, none of the sites had control devices that were completely adequate for the conditions encountered. Some sites were signed more than others, probably because of complaints or because of the knowledge of past problems. The sites, for the most part, were typical of all Jefferson County roads as far as traffic control device applications. Warning and guide signs are used sparingly on most of the road system. Pavement markings are all but nonexistent on county roads as is roadside delineation.

One problem encountered at several of the study sites was installation of standard signs at locations not warranted and the overuse of one particular sign. The "School Bus Stop Ahead" sign was installed on almost every county road. In almost every case, the sign did not meet the warrants of the Manual of Uniform Traffic Control Devices (MUTCD). This sign was meant to be installed in advance of a location which is not visible for a distance of at least 500 feet. It was not intended to be used at every location where a bus stops to load or unload children. Use of this sign or any other sign indiscriminately at unwarranted locations is a waste of money and tends to cause drivers to ignore signs over a period of time.

Hierarchy of signs is also an important factor in the value of sign installations. For instance, a school bus stop at a curve location may have a warning sign for the school bus stop but no indication of the impending curve, which is the most immediate and critical hazard. Once the driver is informed of the most immediate danger, his reaction to that information, (slowing down) should position him to encounter the lesser hazard. If the bus stop location is actually a clear and present hazard it would be best to relocate it rather than risk a tragic accident.

In some areas, signing is applied conservatively while others have no signing. This is understandable, considering the limited budget of county governments. This study recommends a high degree of signing and pavement marking application at the study sites. Since consistency of signing and pavement marking is extremely important, Jefferson County should plan on revising the applications and locations of signs and pavement markings on all county roads after these improvements are implemented. This work should be considered a long range goal of the county, since the needs are great and the funds are limited. Standard traffic control devices applied consistently will aid in the future elimination of accidents county wide.

Study Applications - From past experience, it has been discovered that the methods utilized in these type of studies provide quite different results when applied to an urban area as opposed to rural country roads. In this case, the application of study methods is ideally suited to the rural road system in Jefferson County. Even when considering this fact, the highest priority sites were on the most rural, low volume sections of roadway. This situation should be expected, since cluster sites on low volume roads have a higher accident rate; speeds are higher and thus severity is usually greater; and the cost of making significant improvements is usually less. Since the site selection process for this study was based on statistical indicators based on these factors, the low volume rural roads usually ranked high.

Traffic Accidents -

Traffic accident characteristics for all of the Jefferson County sites are summarized at right.

ACCIDENT STATISTICS

ALL JEFFERSON COUNTY SITES

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR	9	12	16	9	11	57

	OFF RD.	ANG	HED ON	SDE SWP	RER END	OTHER
ACCIDENT TYPE	40	2	5	4	2	5

	C	CL	R	S	F
WEATHER	37	13	3	5	

	D	W	I	S
ROAD CONDITION	29	5	14	10

	DAY		NITE
LIGHT CONDITION	32		25

	PDO		INJ		FATA
SEVERITY	45		12		

	YES		NO
ALCOHOL INVOLVED	14		43

Of all the years in this period, 1988 had the least number of accidents. The predominance of rural sites is evident in the statistics, since they are primarily single vehicle accidents. Most of the accidents occurred in clear weather on dry roads. Night time accidents were not as common as daytime accidents and property damage accidents outweighed injury accidents. No fatal accidents occurred within the study sites. Alcohol involvement played only a minor role, since only 24% of the accidents involved drivers who had been drinking.

Future System Characteristics - Jefferson County does not have a formal transportation plan. It was noted, from historical traffic volume data, that growth in Jefferson County is somewhat stagnant and in some cases traffic has been decreasing. Because of this, long term improvements were not suggested unless the situation required critical attention in the future.

STUDY METHODOLOGY

The study was segregated into four distinct phases which best achieved the purpose and scope of the traffic study. These phases are outlined as follows:

Phase 1, Site Selection - involved copying all of the accident reports on Jefferson County roads for the years 1985 thru 1989 from Department of Justice files in Helena, Montana. These reports were first arranged alphabetically and separated according to road names. Reports on each individual road were screened for location by intersecting roadway and cross referenced. Finally, the reports were plotted on county grid maps to identify cluster areas. All identified clusters having less than three accidents during the reporting period were discarded. The remaining accidents were entered into a computer program to calculate preliminary hazard index values.

Number of accidents, accident rates and severity indexes were calculated for nineteen cluster sites. Table 2. is a summary of the screening program. The cluster sites were ranked according to the composite value of the three indexes. A recommended list of sites was sent to Jefferson County for their approval. The list was modified due to current and local knowledge of projects in progress and other valid reasons and the final list of sites was approved.

TABLE 2.
JEFFERSON COUNTY ACCIDENT CLUSTER SITE SELECTION MATRIX - PRELIMINARY

SITE NO.	MAJOR ROUTE	INTERSECTION OR LOCATION	ACCIDENTS / YEAR 85	86	87	88	89	TOT NO. ACC	NO. ACC. INDX	APPX VOL.	ACC. RATE	ACC. RATE INDX	SVRT INDX	COMPOSITE SCREN INDX	REMARKS
1	I-15 FRONTAGE RD	@ HANGING TREE LANE	4	0	3	1	1	9	64	800	7.71	106	43	73.5	RECOMMENDED SITE
2	SADDLE MOUNTAIN RD	1.0-1.2 E OF McCLELLAN RD	0	1	1	1	0	3	40	300	6.85	99	40	63.0	"
3	FOREST PARK DRIVE	0.5-0.7 MI WEST I-15	0	2	1	1	2	6	54	800	5.14	83	40	60.8	"
4	PIEDMONT ROAD	0-0.4 MI SW OF KOUNTZ RD	0	3	1	0	2	6	54	400	5.14	83	33	58.5	"
5	WARM SPRINGS CR RD	2.1-2.3 MI SE OF I-15	0	1	1	0	1	3	40	300	4.57	77	49	57.5	"
6	LUMP GULCH ROAD	4.0-4.6 MI W CLANCY FRNTG RD	1	1	5	2	2	11	69	600	4.19	73	29	57.2	"
7	CLANCY CREEK RD	3.4-4.0 MI SW OF CLANCY	2	1	1	1	0	5	50	300	3.81	68	42	54.4	"
8	CORBIN-WICKES RD	1.5 MI W OF JEFFERSON CITY	1	0	1	1	1	4	45	500	5.48	87	22	54.0	"
9	BASIN CREEK RD	1.0-1.8 MI N OF BASIN	0	0	0	1	6	7	58	300	4.00	70	22	51.0	CURRENT PROJECT
10	McCLELLAN CR RD	0.7-1.8 MI SE OF HWY 518	3	3	2	2	1	11	69	700	2.15	44	41	50.1	"
11	CLANCY FRONTAGE RD	@ LUMP GULCH ROAD	0	0	2	0	1	3	40	600	3.42	63	40	48.8	ALTERNATIVE SITE
12	MAIN STREET CLANCY	@ CLANCY CREEK RD	3	1	0	0	0	4	45	700	3.91	69	22	47.1	"
13	I-15 FRONTAGE RD	@ PINECREST RD	0	1	1	0	2	4	45	800	3.42	63	22	44.6	"
14	UNIONVILLE ROAD	0.0-0.8 MI N OF TRAVIS CR RD	0	0	1	2	0	3	40	400	1.28	29	49	38.8	"
15	WHITETAIL RD	1.5-2.3 MI S OF HWY 69	1	1	0	1	0	3	40	400	1.28	29	49	38.8	"
16	MT HIGHWAY 2	0.8-1.2 MI NW OF LA HOOD PARK	0	0	2	1	0	3	40	900	1.14	26	49	37.7	"
17	MT HIGHWAY 2	4.0-4.8 MI W OF WHITEHALL	0	1	2	2	0	5	50	900	0.95	22	42	36.7	"
18	FRONTAGE ROAD	@ SEC HIGHWAY 518	0	0	2	0	1	3	40	1000	2.05	42	22	35.2	"
19	SEC HIGHWAY 518	0.7-1.2 MI E OF I-15	0	1	2	0	0	3	40	1000	0.82	20	40	32.1	"
	TOTALS =		15	17	28	16	20	96							
	AVERAGES =		0.8	0.9	1.5	0.8	1.1	5.1	48.7	615.8	3.5	60.7	36.9	49.5	

Phase 2, Data Collection - included preliminary organization of the project including scheduling, site location, form processing, field data collection and reduction of data. Accident data was obtained from reports provided by the Department of Justice. Traffic counts were taken at each location. The existing average daily traffic was determined by applying factors for hourly, daily and monthly variations. Historical traffic volumes were provided by Montana Department of Highways. Other data collected in the field, included measurement of road widths and geometrics, and inventory of traffic control devices, turning movement counts and subjective observation of traffic operations. Aerial photographs were used to develop horizontal alignment.

Phase 3, Analysis of Data - included the determination of hazard indexes for each location by using the Federal Highway Administration Report *No. FHWA-RD-77-83 "Identification of Hazardous Locations".* Computations involved with accidents, volumes, capacities, indicator values and other aspects of hazard indexes were performed on the microcomputer. From these computations a preliminary hazard ranking list was prepared.

Phase 4, Evaluation of Corrective Measures - included the determination of improvements that would reduce or eliminate certain types of accidents or accidents in general at the study locations. Preliminary designs of those improvements included signing, geometric changes, and reconstruction. The improvements were recommended on a short term basis. In most cases, the nature of the sites was such that long term improvements could not be recommended.

Cost effectiveness calculations of the improvements at each location were determined by preparing preliminary cost estimates and computing economic benefits to arrive at a benefit/cost ratio. The method used to determine benefit/cost ratios is identical to that used by the Montana Department of Highways Project Planning Section. All values used in the formulation were supplied by Hank Butzlaff, supervisor of that section. The composite hazard index ranking and benefit/cost ratio, then determined the final priority listing.

HAZARD INDEX ANALYSIS RESULTS

Seven hazard indexes were used as the preliminary basis of ranking hazardous sites. The following are brief descriptions of each index including data format, data collection, indicator scaling and site ranking with respect to each index.

1. **Number of Accidents** - This indicator provides a historical background of accidents at the investigation site. In the case of Jefferson County, a five year period was used, which included 1985 - 1989. The accident reports were photo copied in Helena and provided to the consultant. The data represents all reports filed on county roads in Jefferson County.

Figure 3. is a curve extracted from the FHWA report which is used to determine the indicator value. The data base is number of accidents per year. This indicator, as all of the seven indicators used in the report, is scaled between 0 and 100. An average of two accidents per year in a three year period indicates a hazardous location (indicator value of 33). Ten accidents on the average per year is used to designate a very hazardous location (indicator value of 67). In the case of this study where low volume roads are involved, the total accidents number of accidents per site criteria was used to extract the index value. This higher value is therefore more consistent with the level of the other index values. Using an annual rate would scale down the importance of this indicator relative to other index values. Table 3. is the computer generated ranking of all sites based on this indicator.

TABLE 3. SITE RANKING BY NUMBER OF ACCIDENTS

RANK NO.	MAJOR ROUTE	ACCIDENTS / YEAR 85	86	87	88	89	TOT NO. ACC.	NO. ACC. INDEX
1	McCLELLAN ROAD	3	3	1	2	1	10	67
2	LUMP GULCH ROAD, 4 MILE	1	1	4	2	2	10	67
3	I-15 FRTG. RD - HANGING TREE LN	4	0	3	1	1	9	64
4	PIEDMONT ROAD - KOUNTZ ROAD	0	3	1	0	2	6	54
5	FOREST PARK ROAD	0	2	1	1	2	6	54
6	CLANCY CREEK ROAD	1	1	1	1	0	4	45
7	CORBIN - WICKES ROAD	0	0	1	1	1	3	40
8	LUMP GULCH, CLANCY FRONTAGE	0	0	2	0	1	3	40
9	SADDLE MOUNTAIN ROAD	0	1	1	1	0	3	40
10	WARM SPRINGS CREEK ROAD	0	1	1	0	1	3	40
	TOTALS =	9	12	16	9	11	57	
	AVERAGES =	0.9	1.2	1.6	0.9	1.1	5.7	51

2. Accident Rate Indicator - This indicator somewhat compensates for any incomplete information provided by the number of accident indicator in that an exposure value is provided by the relationship between accidents and the total volume of vehicles using the facility. The data base for this indicator is expressed as the number of accidents per million entering vehicles. In the case of an intersection, "million entering vehicles" is the sum of the daily average approach volumes on all legs of the intersection, multiplied by the number of days in the analysis period.

The accident rate indicator is a very important part of the hazard index ranking method and data collection is possible when a continued program of traffic counting has been performed. Spot counts adjusted by yearly volume increases, seasonal variations, daily variations and hourly variations were necessary at most of the sites to develop an average daily traffic figure applied to the analysis period. The length of the cluster areas was extremely variable in this study. If the volumes were applied on a per site basis, the bias would be toward the longer sections. Therefore, the indicator was used by calculating number of accidents per million vehicles per 0.2 mile sections.

Figure 4 represents the graphic plot of accident rate versus indicator value. As before, the indicator value ranges between 0 and 100. Table 4 is the computer generated ranking of sites based on this indicator.

TABLE 4. SITE RANKING BY ACCIDENT RATE

RANK NO.	INTERSECTION LOCATION	TOTAL ACCIDEN 5 YEARS	1990 ADT	5 YEAR PERIOD AVERAGE	ACCIDENTS PER MVE	ACC RATE IND VAL
1	CLANCY CREEK ROAD	4	250	250	8.77	100
2	WARM SPRINGS CREEK ROAD	3	200	200	5.48	87
3	SADDLE MOUNTAIN ROAD	3	300	300	5.48	87
4	LUMP GULCH ROAD, 4 MILE	10	400	400	4.57	77
5	LUMP GULCH, CLANCY FRONTAGE	3	200	200	4.11	72
6	I-15 FRTG. RD - HANGING TREE	9	1,650	1,700	2.90	56
7	PIEDMONT ROAD - KOUNTZ ROAD	6	720	650	2.53	50
8	FOREST PARK ROAD	6	680	650	2.53	50
9	CORBIN - WICKES ROAD	3	500	450	1.46	32
10	McCLELLAN ROAD	10	900	900	1.22	28
	AVERAGE VALUES =	6	580	570	4	64

3. Accident Severity Indicator - Although there are many factors involved in the severity of accidents, statistical studies over a significant number of years have given fairly reliable dollar values in terms of economic loss for each type of accident. The accident severity indicator correlates a probable cause and effect relationship which aids in the determination of the level of accident reduction measures required. Severity values can also be used as a determinant of benefits resulting from various improvements.

The data base for accident severity is average relative severity in thousands of dollars. Data collection necessary for the use of the severity index is made possible by the accident report form. Dollar values for severity were provided by Hank Butzlaff of the Montana Department of Highways. They are: Fatal Accident = $500,000, Injury Accident = $11,000 and Property Damage Accident = $1,500.

The FHWA report presents the relative severity index values for each type of accident. Once the type of accident has been established, Figure 5 enables the user to assess the indicator value. Figure 5 is a graphic plot of the average severity in thousands of dollars versus the indicator value which is based on a scale of 0 to 100. Table 5 is the computer generated ranking of sites based on this indicator.

TABLE 5. SITE RANKING BY ACCIDENT SEVERITY

RANK NO.	INTERSECTION LOCATION	SUM OF SEVERITY VALUES	TOTAL NO. ACC.	AVERAGE SEVERITY INDEX	INDICATO VALUE
1	WARM SPRINGS CREEK ROAD	$23,500	3	$7,833	59
2	PIEDMONT ROAD - KOUNTZ ROAD	$37,500	6	$6,250	54
3	SADDLE MOUNTAIN ROAD	$14,000	3	$4,667	48
4	FOREST PARK ROAD	$28,000	6	$4,667	48
5	LUMP GULCH, CLANCY FRONTAGE	$14,000	3	$4,667	48
6	CLANCY CREEK ROAD	$15,500	4	$3,875	44
7	I-15 FRTG. RD - HANGING TREE	$32,500	9	$3,611	43
8	LUMP GULCH ROAD, 4 MILE	$34,000	10	$3,400	42
9	McCLELLAN ROAD	$24,500	10	$2,450	37
10	CORBIN - WICKES ROAD	$4,500	3	$1,500	31
	TOTAL SEVERITY $ =	$228,000			
	TOTAL NO. ACC. =		57		
	AVE. SEVERITY / ACC. =			$4,000	
	AVE. IND. VAL / SITE =				45

4. **Volume to Capacity Ratio Indicator** - This indicator not only produces exposure rates but also incorporates existing roadside features and conditions such as traffic type, turning directions, volume mix and number of lanes.
Computation of the volume capacity indicator is expressed as follows:

$$V/C = ADT/24\ HOUR\ CAPACITY$$

Again, the low volume nature of these sites would dilute the relative importance of this indicator if calculated in this manner. Therefore, volume/capacity calculation using the 1985 Highway Capacity Manual procedures were used and expressed as a peak hour V/C. If the above formula were used, the maximum index value would have been less than 10 and more than half of the sites would have been at or near zero.

Data required for the volume capacity ratio involves field measurements of existing geometrics, turning counts and volume mix. The capacity of each section of road or intersection is computed through methodology presented in the 1985 *Highway Capacity Manual* using FHWA computer software. Although this indicator is cumbersome to use by inexperienced personnel, its inclusion is considered necessary and correlates well in hazardous index ranking.

Figure 6. presents a graphic plot of the volume capacity ratio versus the indicator value which is also scaled between 0 and 100. Table 6. is the computer generated ranking of the sites based on this indicator.

TABLE 6. SITE RANKING BY VOLUME/CAPACITY RATIOS

RANK NO.	INTERSECTION LOCATION	PEAK HOUR CAPACITY	PEAK HOUR FLOW	V/C RATIO	V/C INDICATO VALUE
1	McCLELLAN ROAD	241	108	0.45	71
2	I-15 FRTG. RD - HANGING TREE LN	466	205	0.44	70
3	LUMP GULCH ROAD, 4 MILE	162	50	0.31	55
4	FOREST PARK ROAD	274	78	0.28	52
5	WARM SPRINGS CREEK ROAD	110	25	0.23	44
6	SADDLE MOUNTAIN ROAD	187	36	0.19	40
7	CLANCY CREEK ROAD	137	25	0.18	38
8	PIEDMONT ROAD - KOUNTZ ROAD	551	80	0.15	33
9	CORBIN - WICKES ROAD	494	54	0.11	27
10	LUMP GULCH, CLANCY FRONTAGE	248	25	0.10	25
	AVERAGE VALUES	287	69	0	45

5. Sight Distance Indicator - This indicator is of significant value in rural locations, especially at intersecting roads. Even though the weighting factor in the hazard index computation is low, it is still considered valuable in determining deficiencies on unimproved county roads.

The data format for using the sight distance indicator is the ratio of actual sight distance to desirable sight distance. The FHWA report presents the minimum stopping sight distance on wet pavement for the various design speeds. Actual stopping sight distance is the distance from the drivers position to the point where a stop may be required to avoid a hazardous maneuver or direct collision.

The data format for this indicator is the sight distance ratio of actual over desirable. Collection of the sight distance data requires field measurements of sight distance and determination of average travel speeds. Figure 7. presents a graphic plot of the sight distance ratio versus the indicator value which ranges from 0 to 100. Table 7. is the computer generated ranking of sites based on this indicator.

TABLE 7. SITE RANKING BY SIGHT DISTANCE

RANK NO.	INTERSECTION LOCATION	N SD	REQ SD	RATIO	IND VAL	S SD	REQ SD	RATIO	IND VAL	E SD	REQ SD	RATIO	IND VAL	W SD	REQ SD	RATIO	IND VAL	*WT. IND VAL
1	CLANCY CREEK ROAD									100	275	0.36	100	100	275	0.36	100	100
2	LUMP GULCH ROAD, 4 MILE									150	275	0.55	100	150	275	0.55	100	100
3	SADDLE MOUNTAIN ROAD									100	200	0.50	100	100	200	0.50	100	100
4	WARM SPRINGS CREEK ROAD	100	200	0.50	10	100	200	0.50	100									100
5	I-15 FRTG. RD - HANGING TREE	250	400	0.63	82	250	250	1.00	37	125	500	0.25	100	450	500	0.90	45	94
6	LUMP GULCH, CLANCY FRONTAGE	100	200	0.50	100					300	400	0.75	62	300	400	0.75	62	87
7	PIEDMONT ROAD - KOUNTZ ROAD	500	400	1.25	21	150	400	0.38	100	500	275	1.82	2	500	275	1.82	2	74
8	McCLELLAN ROAD	280	400	0.70	69	280	400	0.70	69									69
9	FOREST PARK ROAD									250	275	0.91	44	250	275	0.91	44	44
10	CORBIN - WICKES ROAD	400	400	1.00	37	500	400	1.25	21	400	200	2.00	0					32
																AVERAGE INDICATOR VALUE =		80.0

* WEIGHTED INDICATOR VALUE IS CALCULATED BY THE FORMULA (2xHIGHVAL + 2nd HIGHVAL)/3

N,S,E & W SD's = MEASURED SIGHT DISTANCE ON DIRECTIONAL APPROACHES

REQ SD = REQUIRED SIGHT DISTANCE ACCORDING TO AASHO

6. Driver Expectancy Indicator - This indicator relates human behavior factors to existing road conditions. The value of this indicator is realized in the fact that the roadway geometrics and roadside culture are evaluated on a human judgement basis.

The data format for the driver expectancy index is the problem rating scale. Being a subjective indicator, the degree of expectancy is rated on a scale from 1 to 6, and the expectancy rating varies linearly with the indicator value as shown in Figure 8. The expectancy rating form can be found in the FHWA report for further reference. Table 8. is the computer generated ranking of sites based on this indicator.

TABLE 8. SITE RANKING BY DRIVER EXPECTANCY

RANK NO.	INTERSECTION LOCATION	NB RATE	SB RATE	EB RATE	WB RATE	WGTD. RATE	IND VAL
1	CLANCY CREEK ROAD			6	6	6.0	100
2	I-15 FRTG. RD - HANGING TREE LN	6	5			5.5	92
3	PIEDMONT ROAD - KOUNTZ ROAD	5	6	6	4	5.3	88
4	LUMP GULCH, CLANCY FRONTAGE	6		5	4	5.0	83
5	WARM SPRINGS CREEK ROAD	5	5			5.0	83
6	McCLELLAN ROAD	4	5			4.5	75
7	FOREST PARK ROAD			4	3	3.5	58
8	LUMP GULCH ROAD, 4 MILE			3	4	3.5	58
9	SADDLE MOUNTAIN ROAD			3	4	3.5	58
10	CORBIN - WICKES ROAD	3	3			3.0	50
				AVERAGE INDICATOR VALUE =			74.6

7. **Information System Deficiencies Indicator** - This indicator also provides a value or subjective judgement on the sufficiency of traffic control devices which transfer necessary information to the operator.

The data format for the information system deficiencies indicator is similar to that of the driver expectancy indicator in that a value form is used to provide a rating between 1 and 6. The rating for this indicator is also plotted linearly between the indicator range values of 0 and 100 and is shown on Figure 9. The value rating form is for the information system deficiencies indicator. It is also presented in the FHWA report for further reference. Table 9. is the computer generated ranking of sites based on this indicator.

TABLE 9. SITE RANKING BY INFORMATION DEFICIENCY

RANK NO.	INTERSECTION LOCATION	NB RATE	SB RATE	EB RATE	WB RATE	WGTD. RATE	IND VAL
1	CLANCY CREEK ROAD			6	6	6.0	100
2	I-15 FRTG. RD - HANGING TREE LN	6	6			6.0	100
3	LUMP GULCH, CLANCY FRONTAGE	6		5	5	5.3	89
4	LUMP GULCH ROAD, 4 MILE			4	6	5.0	83
5	CORBIN - WICKES ROAD	5	5			5.0	83
6	FOREST PARK ROAD			5	5	5.0	83
7	PIEDMONT ROAD - KOUNTZ ROAD	5	5	6	4	5.0	83
8	McCLELLAN ROAD	5	5			5.0	83
9	SADDLE MOUNTAIN ROAD			4	4	4.0	67
10	WARM SPRINGS CREEK ROAD	4	4			4.0	67
					AVERAGE INDICATOR VALUE =		83.9

HAZARD RANKING

Once all of the data had been collected and the indicator values computed, indicator values and necessary data were transferred to the hazard index computation matrix. Each indicator is weighted in accordance with the FHWA report. The weighting factors are fractional portions of unity. When all nine indicators established in FHWA report are used, the sum of weights is equal to one. In the case of Jefferson County, two indicators were omitted, the Traffic Conflict Indicator and the Erratic Maneuvers Indicator. Their exclusion from the study was not felt to be any deterrent in the ranking of hazardous sites. The use of seven indicators provides an 88.6% confidence in strength of evaluation.

Based on the hazard analysis for each site, a matrix of indicator values and final hazard index ratings was constructed on the computer system and a hazard index ranking was completed. Table 10., on the following page, lists this ranking by site number, location, indicator values and hazard index. Also shown is statistical information for the indicator values and hazard index.

During the process of field data collection and subsequent indicator computations, it was discovered that values for the two subjective indicators could vary widely between consecutive observations and among non-experienced observers. If Jefferson County continues this program, they should retain traffic personnel who will continue to update the high hazard priority list on a long term basis and therefore, these indicators should remain as part of the hazard index ranking.

TABLE 10. SITE RANKING BY HAZARD INDEX - SUMMARY INDICATOR VALUES

RANK NO.	SITE LOCATION	# OF ACC. IND VAL	# OF ACC. PART H.I.	ACC. RATE IND VAL	ACC. RATE PART H.I.	SEVERITY IND VAL	SEVERITY PART H.I.	V/C RATIO IND VAL	V/C RATIO PART H.I.	SIGHT DIST IND VAL	SIGHT DIST PART H.I.	EXPECT. IND VAL	EXPECT. PART H.I.	INFO DEF. IND VAL	INFO DEF. PART H.I.	TOTAL HAZARD INDEX
	* RELATIVES WEIGHTS :		0.16		0.22		0.19		0.08		0.07		0.15		0.12	1.00
1	CLANCY CREEK ROAD	45	7.3	100	22.4	44	8.4	38	3.1	100	7.4	100	14.8	100	11.5	74.9
2	I-15 FRTG. RD - HANGING TREE	64	10.4	56	12.5	43	8.2	70	5.7	94	7.0	92	13.6	100	11.5	69.0
3	WARM SPRINGS CREEK ROAD	40	6.5	87	19.5	59	11.2	44	3.6	100	7.4	83	12.3	67	7.7	68.2
4	LUMP GULCH ROAD, 4 MILE	67	10.9	77	17.2	42	8.0	55	4.5	100	7.4	58	8.6	83	9.5	66.2
5	LUMP GULCH, CLANCY FRONTAGE	40	6.5	72	16.1	48	9.1	25	2.1	87	6.4	83	12.3	89	10.2	62.8
6	SADDLE MOUNTAIN ROAD	40	6.5	87	19.5	48	9.1	40	3.3	100	7.4	58	8.6	67	7.7	62.1
7	PIEDMONT ROAD - KOUNTZ ROAD	54	8.8	50	11.2	54	10.3	33	2.7	74	5.5	88	13.0	83	9.5	61.0
8	McCLELLAN ROAD	67	10.9	28	6.3	37	7.0	71	5.8	69	5.1	75	11.1	83	9.5	55.8
9	FOREST PARK ROAD	54	8.8	50	11.2	48	9.1	52	4.3	44	3.3	58	8.6	83	9.5	54.8
10	CORBIN - WICKES ROAD	40	6.5	32	7.2	31	5.9	27	2.2	32	2.4	50	7.4	83	9.5	41.1
	AVERAGE VALUES :	51		64		45		46		80		75		84		62
	STANDARD DEVIATIONS :	11		23		8		15		24		16		11		9

EXPLANATION OF IMPROVEMENTS

The recommended improvements presented within this report are of two types. Short term improvements indicate the minimum amount of upgrading or modifications necessary to increase driver expectancy and to update the site to current standards. Long term improvements are normally considered viable when severe conditions at the site prevent short term improvements from completely satisfying the control measures necessary to prevent future problems. Since all of the long term improvements are dependant upon significant changes in the future operations and most of the sites were not of a nature that reliable predictions could be made, no costs or project ranking was completed. Many of the recommended improvements have sufficient latitude so that alternative measures could be suggested during design. The selection of recommended improvements was based on subjective engineering judgement.

At some of the sites, it was noted that a few traffic control devices were not in compliance with MUTCD. There also may be several locations where deficiencies may be critical and should be corrected as soon as possible.

The improvement sketches in all cases should not be considered design plans. The drawings are preliminary and are intended to present improvement concepts only in enough detail to provide the measure of control necessary and to provide cost estimates. In some cases, detailed survey data; design research; design plans and specifications; and construction layout will be necessary to effectively achieve the improvements.

BENEFIT/COST RATIOS

COSTS

Preliminary cost estimates are developed by applying unit costs to required quantities based either on current prices as tabulated from average bid prices of similar projects or, where applicable, on prices established by Montana Department of Highways Project Planning Section. The costs should in no way be considered a quote or final estimate of actual work.

The following are traffic control devices and allowable costs that are eligible for funding by the Montana Department of Highways through their Off-System Safety Program:

A. Signs:

1. 1 square foot to 6 square feet - $ 100.00
2. 6.1 square feet to 10 square feet - $ 140.00
3. 10.1 square feet to 20 square feet - $ 170.00
4. supplementary sign on same post - $ 50.00

B. Delineators:

1. Design ""A" metal posts - $ 9.25
2. Design "A" flexible posts-6' - $ 20.00
3. Design "A" flexible posts-27" - $ 6.00

C. Guardrail:

1. New "W" Beam rail (per foot) - $ 8.00
2. "W" Beam end treatment (each) - $ 1,000.00
3. New concrete rail (per foot) - $ 16.00
4. New concrete end tapers (per foot) - $ 16.00

Even though Jefferson County maintenance crews are capable of performing a good deal of work, costs related to physical changes in the roadway section are based on contract prices in order to correlate with costs requiring contract bid letting. The costs do not include administrative, engineering or field layout for the recommended improvements at the one site which would require final design plans. Engineering design will generally be required to produce contract plans and specifications. These costs should be evaluated prior to planning improvement projects requiring bids.

BENEFITS

Estimated benefits are made by applying accident reduction forecasts based on the type of improvement recommended. The forecasts are based on the subjective evaluation by an experienced traffic engineer. This evaluation is aided by knowledge of accident experience at similar locations with the improvements existing. Also statistical studies relating certain improvements to accident reduction are used as a guide ie, Roy Jorgenson and Associates, *"Evaluation of Criteria for Safety Improvements on the Highway" (Washington, D.C.: U.S. Bureau of Public Roads, Office of Highway Safety, 1966. p. 316).*

The forecasted reduction is expressed as a percentage of each type of accident. This percentage is multiplied by the percentage of all accidents represented by each type. The total percent reduction of all accidents at each site is the sum of all accidents reduction percentages for each type.

The method used to compute benefits in this study follows the Montana Department of Highways procedures. Those procedures were programmed for Quatro Pro Computer Software which provides a tabular summary of all variables in the computation.

If applied consistently, the economic benefit computation will provide a realistic estimate of average economic savings to society. The benefit amount should not be interpreted as a dollar value that Jefferson County will receive as a result of dollar

outlay. It is a figure used to quantify the economic benefit to society that would occur if a certain number of accidents did not occur.

RATIO

The B/C provides a numerical reference to the relative value of the recommended improvements. It is the desire of any improvement project to have a benefit-cost (B/C) ratio in excess of 1.0. If the B/C is less than 1.0 the project would have questionable justification. In this study, none of the sites had a B/C less than one. Table 11 is a computer generated summary of the B/C ranking for the study sites.

TABLE 11. SITE RANKING BY BENEFIT/COST RATIOS — CALCULATION SUMMARY

RNK #	SITE LOCATION	PR LIFE	COSTS: CAPITOL COST IMPROVE	COSTS: EQUIV ANNUAL COST	COSTS: ANNUAL MAINT. COST C	COSTS: TOTAL ANNUAL COST	BENEFITS: Q	Afl	Apd	PFI	Ppd	BENEFITS: ANNUAL BENEFIT	B/C RATIO	IND VAL
1	SADDLE MOUNTAIN ROAD	5	$440	$116	$50	$166	$37,164	0.20	0.40	60%	60%	$4,916	29.60	100
2	FOREST PARK ROAD	5	$1,650	$435	$50	$485	$37,164	0.40	0.80	40%	25%	$6,371	13.13	86
3	I-15 FRTG. RD - HANGING TREE LN	5	$2,740	$723	$100	$823	$37,164	0.40	1.40	60%	56%	$10,297	12.51	84
4	PIEDMONT ROAD - KOUNTZ ROAD	5	$4,280	$1,129	$100	$1,229	$37,164	0.60	0.60	60%	45%	$14,060	11.44	81
5	WARM SPRINGS CREEK ROAD	5	$2,940	$776	$50	$826	$37,164	0.40	0.20	60%	60%	$9,281	11.24	81
6	CLANCY CREEK ROAD	5	$1,980	$522	$50	$572	$37,164	0.20	0.60	60%	53%	$5,035	8.80	72
7	LUMP GULCH ROAD, 4 MILE	5	$6,120	$1,614	$100	$1,714	$37,164	0.40	1.60	50%	34%	$8,414	4.91	53
8	McCLELLAN CREEK ROAD	5	$4,960	$1,308	$150	$1,458	$37,164	0.20	1.80	60%	39%	$5,623	3.86	45
9	LUMP GULCH, CLANCY FRONTAGE	5	$1,500	$396	$50	$446	$37,164	0.20	0.40	20%	20%	$1,639	3.68	43
10	CORBIN - WICKES ROAD	5	$1,480	$390	$50	$440	$37,164	0.00	0.60	0%	60%	$551	1.25	7
	TOTALS :		$28,090	$7,410	$750	$8,160						$66,187		
	AVERAGES :	5	$2,809	$741	$75	$816						$6,619	10.04	65

COMPOUNDED INTEREST RATE :	10%
COST OF FATAL ACCIDENT :	$500,000
COST OF INJURY ACCIDENT :	$11,000
COST OF PROPERTY DAMAGE ACCIDEN	$1,500
I/F RATIO SECONDARY :	17.69
ADTa/ADTb :	1.02

VALUES FROM MDOH SAFETY SECTION

PRIORITY INDEX

The ranking of site improvement priorities cannot be directly dependent on the hazard ranking of the study sites. The value of the improvements must enter into the priority listing in the form of the benefit/cost ratio (B/C). The method of developing a composite Hazard Index - B/C listing must be dependent on the relative index scale used in the hazard index computation. Therefor, a correlation of scale between the B/C ratio and hazard indicator value was developed on the following assumptions:

1. The contributing conditions creating hazards at each site and the resulting hazard ranking is relatively independent of the cost of correcting these conditions.
2. Benefits to be derived from correcting hazardous situations at each site is indirectly proportional to the degree of hazardness.
3. The benefit/cost ratio, by virtue of benefit computation, is indirectly proportional to the number of accidents indicator and severity indicator, both of which are curvilinear functions.
4. The benefit/cost ratios can be rated on a scale of 0 to 100 based on a curvilinear function.
5. The B/C ratio of 1.0 is equivalent to an indicator value of 0 and the upper limit (indicator value = 100) must be chosen to encompass the majority of sites.

In this case, a B/C of 20.0 and above assumes the indicator value of 100. Based on these assumptions a graphic plot of the B/C ratio versus B/C indicator value has been established and it is shown in Figure 10. Since it has been graphed on semi-log paper the line appears linear.

Since the relative weighting of benefit/costs and hazardness is a controversial subject which would require research beyond the scope of this report, it is felt that the priority index should be based on 33% weighting for the benefit-cost ratio and 67%

weight on the hazard index. Therefore, to establish a priority index the following formula has been devised:

$$\text{Priority Index} = (\text{Hazard Index}) \times (0.67) + (\text{Benefit/Cost Indicator}) \times (0.33)$$

Table 12. is the computer generated summary of priority ranking based on the composite hazard index - benefit/cost index values.

TABLE 12. SITE RANKING BY PRIORITY INDEX - SUMMARY

PRIORITY NUMBER	INTERSECTION LOCATION	HAZARD INDEX	WEIGHTED VALUE	BEN/COST INDEX	WEIGHTED VALUE	PRIORITY INDEX
1	SADDLE MOUNTAIN ROAD	62.10	41.61	100	33.00	74.61
2	I-15 FRTG. RD - HANGING TREE LN	69.00	46.23	84	27.72	73.95
3	CLANCY CREEK ROAD	74.90	50.18	72	23.76	73.94
4	WARM SPRINGS CREEK ROAD	68.20	45.69	81	26.73	72.42
5	PIEDMONT ROAD - KOUNTZ ROAD	61.00	40.87	81	26.73	67.60
6	FOREST PARK ROAD	54.80	36.72	86	28.38	65.10
7	LUMP GULCH ROAD, 4 MILE	66.20	44.35	53	17.49	61.84
8	LUMP GULCH, CLANCY FRONTAGE	62.80	42.08	43	14.19	56.27
9	McCLELLAN ROAD	55.80	37.39	45	14.85	52.24
10	CORBIN - WICKES ROAD	41.10	27.54	7	2.31	29.85
	AVERAGE VALUES :	61.59	41.27	65.20	21.52	62.78
	STANDARD DEVIATIONS :	8.94	5.99	26.42	8.72	13.23

PRIORITY INDEX = (HAZARD INDEX x 0.67) + (BENEFIT/COST INDEX x 0.33)

IMPLEMENTATION

Within Table 13, the priority lists have been arranged in a manner in which budget considerations can readily be applied in the decision to proceed with improvements. The priority ranking was the major consideration in selecting which sites will be receiving funds first. Since limited funds are available, it is usually necessary to skip over a few higher priority projects to improve a greater number of sites as soon as possible. The listing assumes that eligible project costs will be funded by MDOH Off-system Safety funds. The MDOH project funding limit is less than $10,000 per project period, or else formal bid letting procedures would be required by MDOH. This dollar figure is used as the criteria to define construction groupings. The estimated costs not covered by MDOH funds are considered County funding requirements. If Jefferson County forces perform this work, the actual costs would probably be much less.

There is no timetable given for these improvements. It may be conceivable that MDOH could fund more than one of the site groups in a single year, depending on available funding. The County will want to request funding from MDOH by submitting this report to Steve Kologi, P.E., Administrator, Program Development Coordinator.

TABLE 13. PROJECT IMPLEMENTATION SCHEDULE

PRIORITY NUMBER	LOCATION	COST ESTIMATE	M.D.O.H. ELIGIBLE FUNDS	COUNTY FUNDS
1	SADDLE MOUNTAIN ROAD	$440.00	$440.00	$0.00
2	I-15 FRONTAGE ROAD	$2,740.00	$2,620.00	$120.00
3	CLANCY CREEK ROAD	$1,980.00	$540.00	$1,440.00
4	WARM SPRINGS CREEK ROAD	$2,940.00	$540.00	$2,400.00
5	PIEDMONT - KOUNTZ ROAD	$4,280.00	$1,400.00	$2,880.00
6	FOREST PARK ROAD	$1,650.00	$1,250.00	$400.00
7	LUMP GULCH ROAD, 4 MILE	$6,120.00	$2,280.00	$3,840.00
8	LUMP GULCH, CLANCY FRONTAGE	$1,500.00	$660.00	$840.00
	CONSTRUCTION GROUP #1 TOTAL =	$21,650.00	$9,730.00	$11,920.00
9	McCLELLAN ROAD	$4,960.00	$2,640.00	$2,320.00
10	CORBIN - WICKES ROAD	$1,480.00	$1,300.00	$180.00
	CONSTRUCTION GROUP #2 TOTAL =	$6,440.00	$3,940.00	$2,500.00
	TOTAL CONSTRUCTION COSTS =	$28,090.00	$13,670.00	$14,420.00

PROGRAM CONTINUATION

Since the basic format of the study has been outlined and an initial priority list established, continuance of the program is strongly advised. The findings and recommendations of this study will soon become obsolete without continued updating at least on an annual basis. The following recommendations in the continuance of the program are offered to Jefferson County:

1. The Department of Justice should continue to be assessed for copies of accident reports.
2. One person should be assessed with the responsibility of the program to insure that all data is being supplied, processed and filed.
3. An accident cluster map should be maintained.
4. Criteria should be developed for the inclusion of additional sites to be analyzed.
5. Coordinate any traffic counting programs that may exist or establish a counting program.
6. Analyze new sites according to the procedures of this study and include them in the priority list when warranted.

All of the data processing and storage can be handled by most computer spreadsheet software programs. If an IBM compatible computer is available for use by the county, a copy of the data disk will be provided.

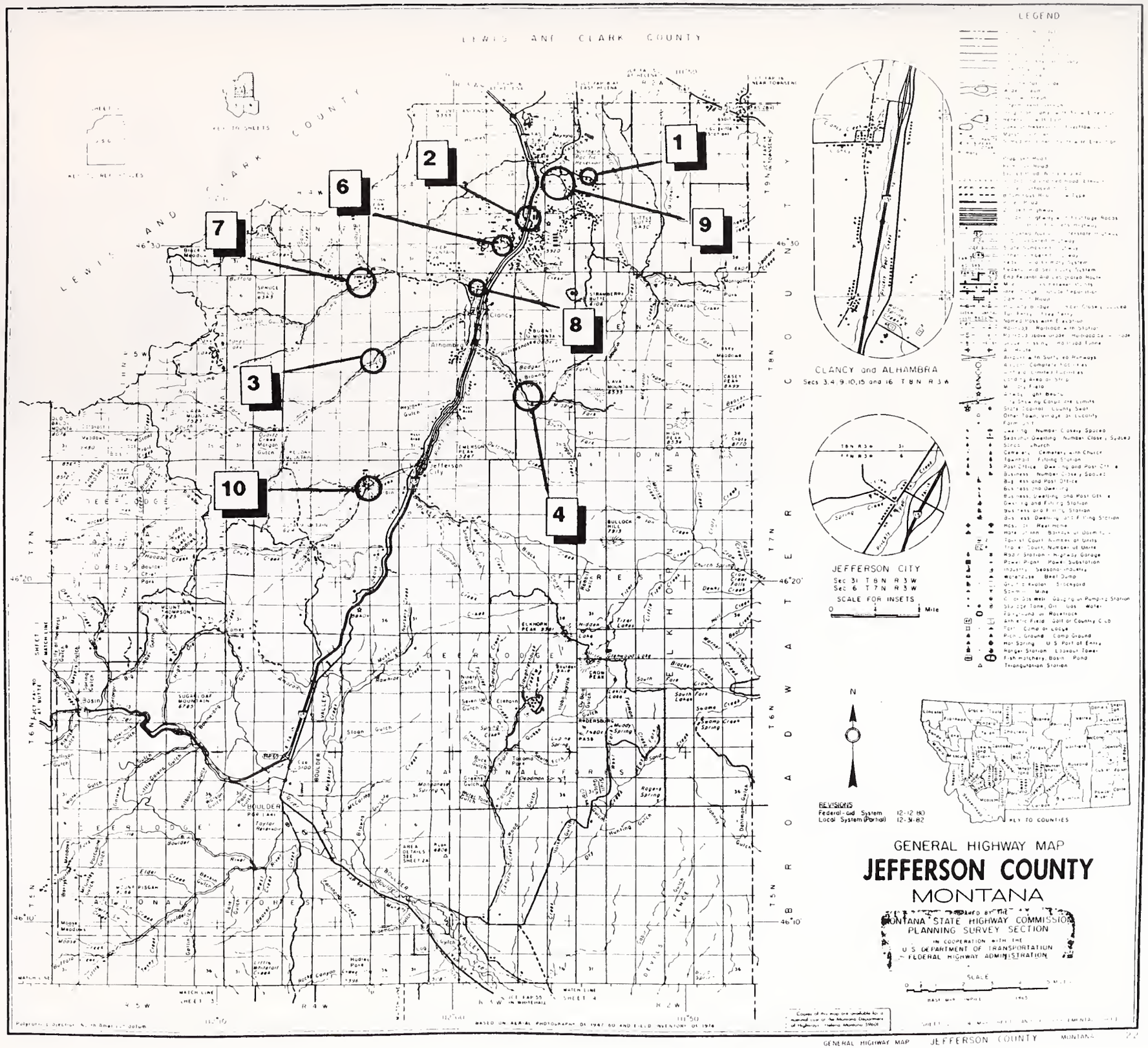
REPORT

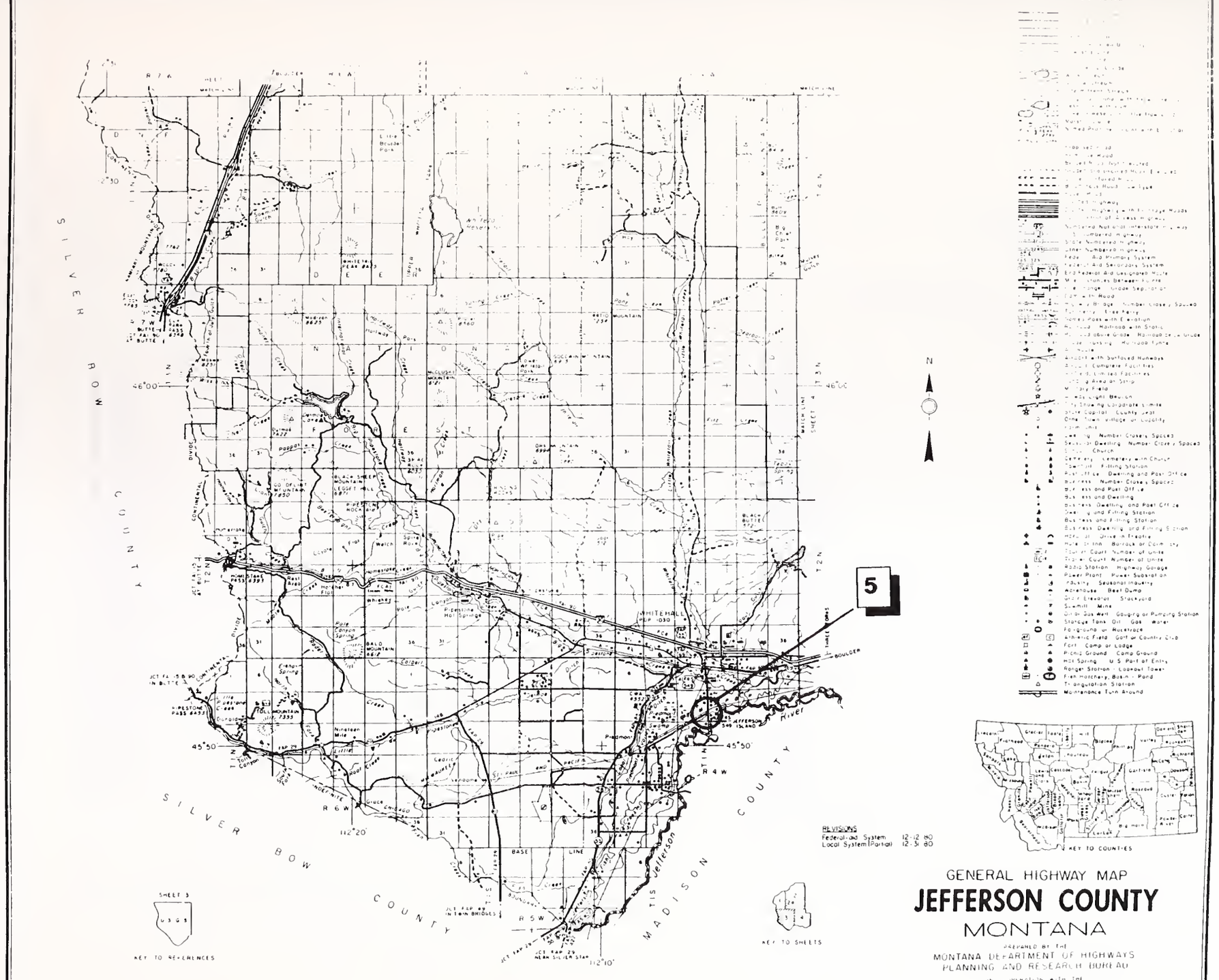
FIGURES

FIGURE 1.

SITE LOCATION

MAPS


LEWIS AND CLARK COUNTY
1
2
3
4
6
7
8
9
10
CLANCY and ALHAMBRA
Secs 3,4 9,10,15 and 16 T 8 N R 3 W
JEFFERSON CITY
Sec 31 T 8 N R 3 W
Sec 6 T 7 N R 3 W
SCALE FOR INSETS
0 1 Mile
LEGEND
N
REVISIONS
Federal-Aid System 12-12-80
Local System (Partial) 12-31-82
KEY TO COUNTIES
GENERAL HIGHWAY MAP
JEFFERSON COUNTY
MONTANA
PREPARED BY THE
MONTANA STATE HIGHWAY COMMISSION
PLANNING SURVEY SECTION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALE
BASED ON AERIAL PHOTOGRAPHS OF 1967-69 AND FIELD INVENTORY OF 1974


LEGEND
N
5
SILVER BOW COUNTY
MADISON COUNTY
Jefferson River
BOULDER
WHITEHALL
PRESTON PASS
BALD MOUNTAIN
R 6 W
R 5 W
R 4 W
T 2 N
T 3 N
112°20'
112°10'
45°50'
46°00'
SHEET 3
USGS
KEY TO REFERENCES
KEY TO SHEETS
KEY TO COUNTIES
REVISIONS
Federal-aid System 12-12-80
Local System (Partial) 12-31-80
GENERAL HIGHWAY MAP
JEFFERSON COUNTY
MONTANA
PREPARED BY THE
MONTANA DEPARTMENT OF HIGHWAYS
PLANNING AND RESEARCH BUREAU
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALE
MILES
BASE MAP 1 INCH = 1 MILE
Polyconic projection North American Datum
BASED ON AERIAL PHOTOGRAPHY OF 1967 80 AND 1974 INVENTORY
GENERAL HIGHWAY MAP JEFFERSON COUNTY MONTANA

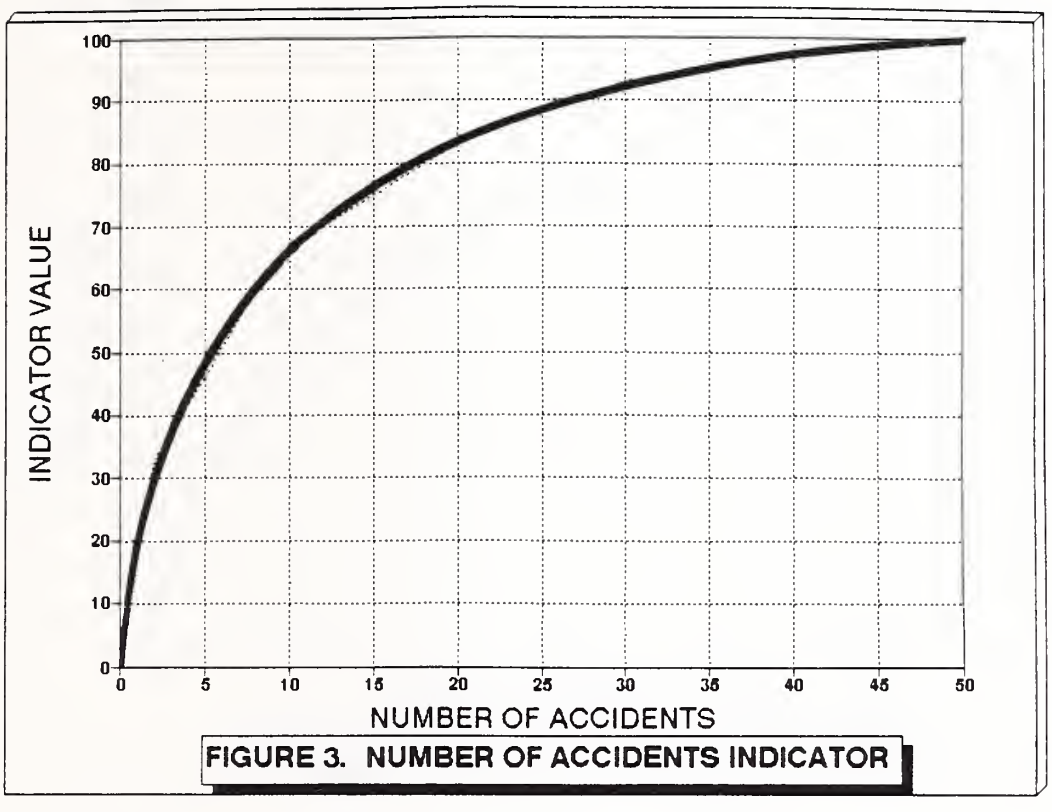


FIGURE 3. NUMBER OF ACCIDENTS INDICATOR

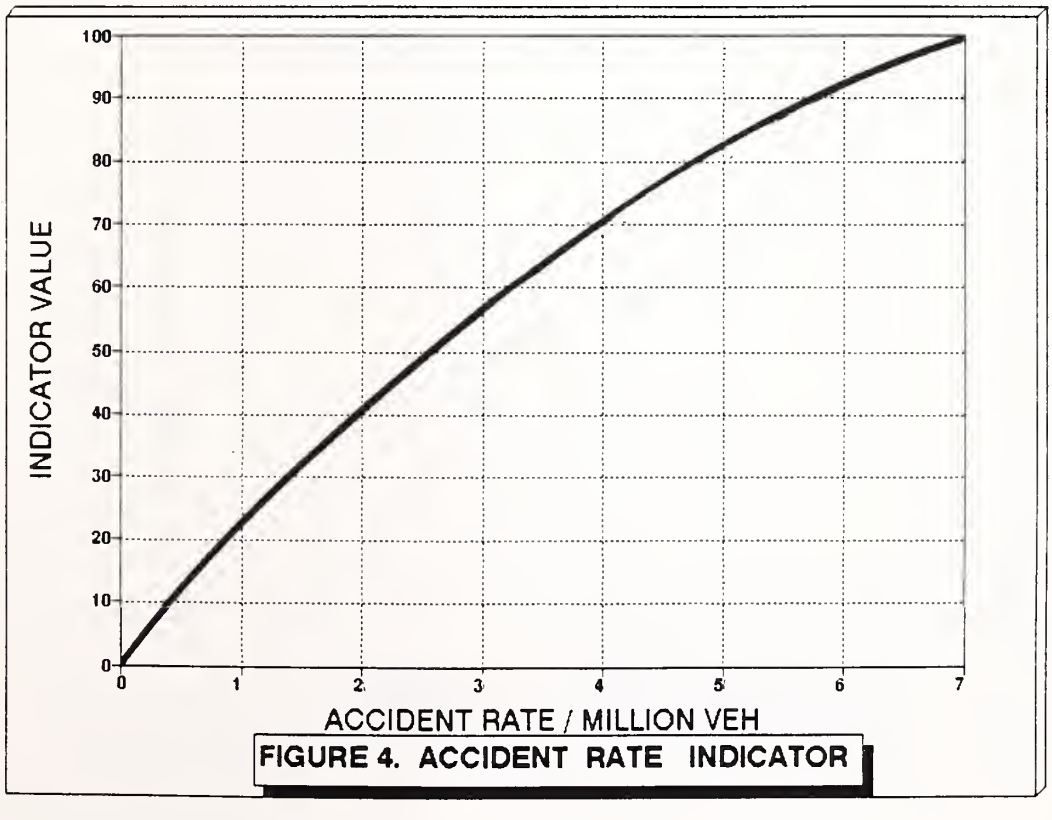


FIGURE 4. ACCIDENT RATE INDICATOR

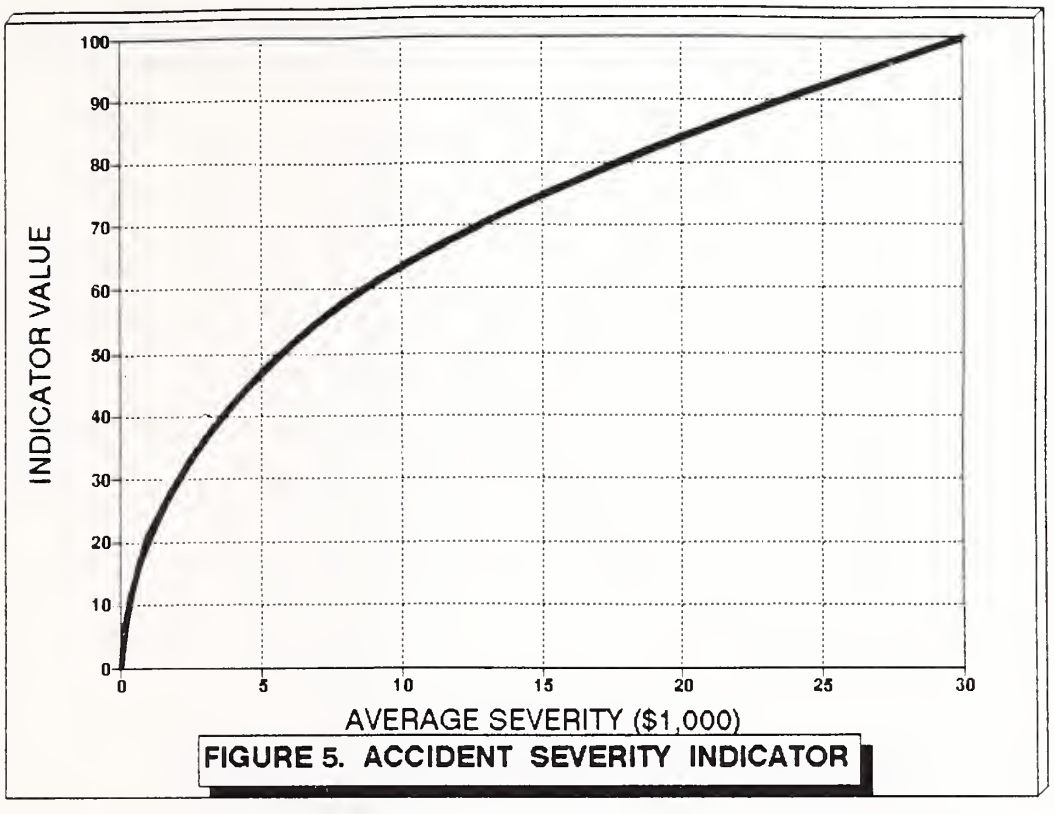


FIGURE 5. ACCIDENT SEVERITY INDICATOR

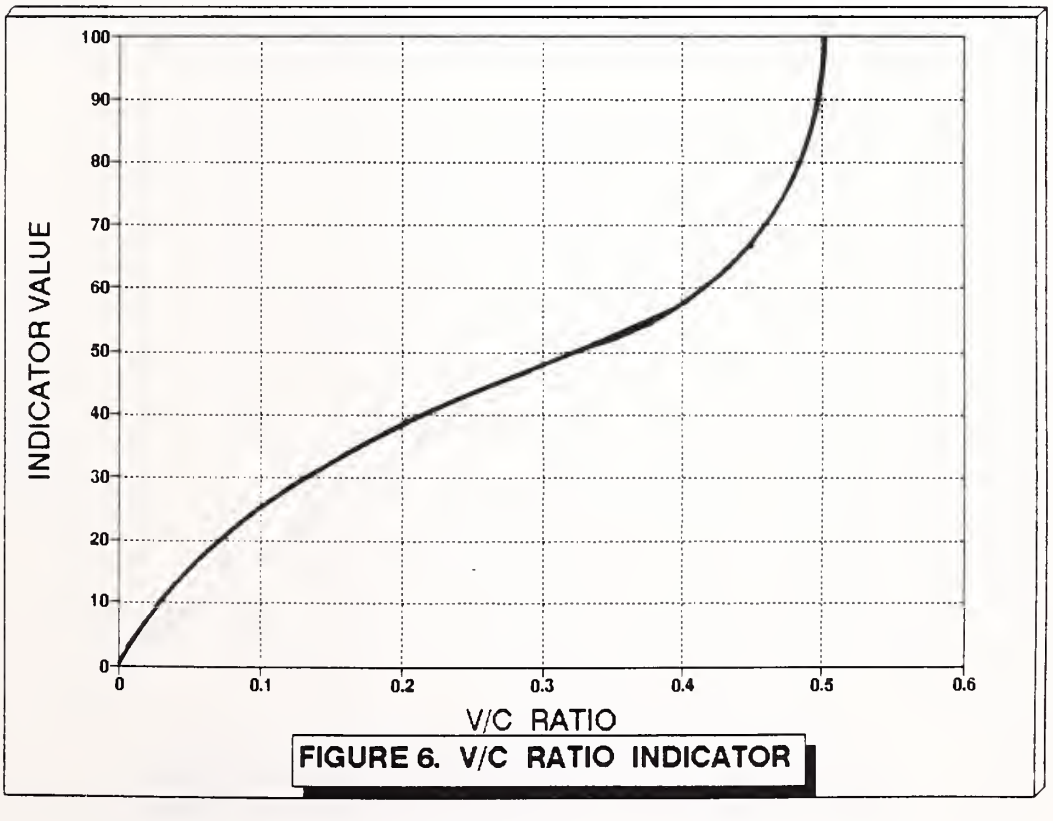


FIGURE 6. V/C RATIO INDICATOR

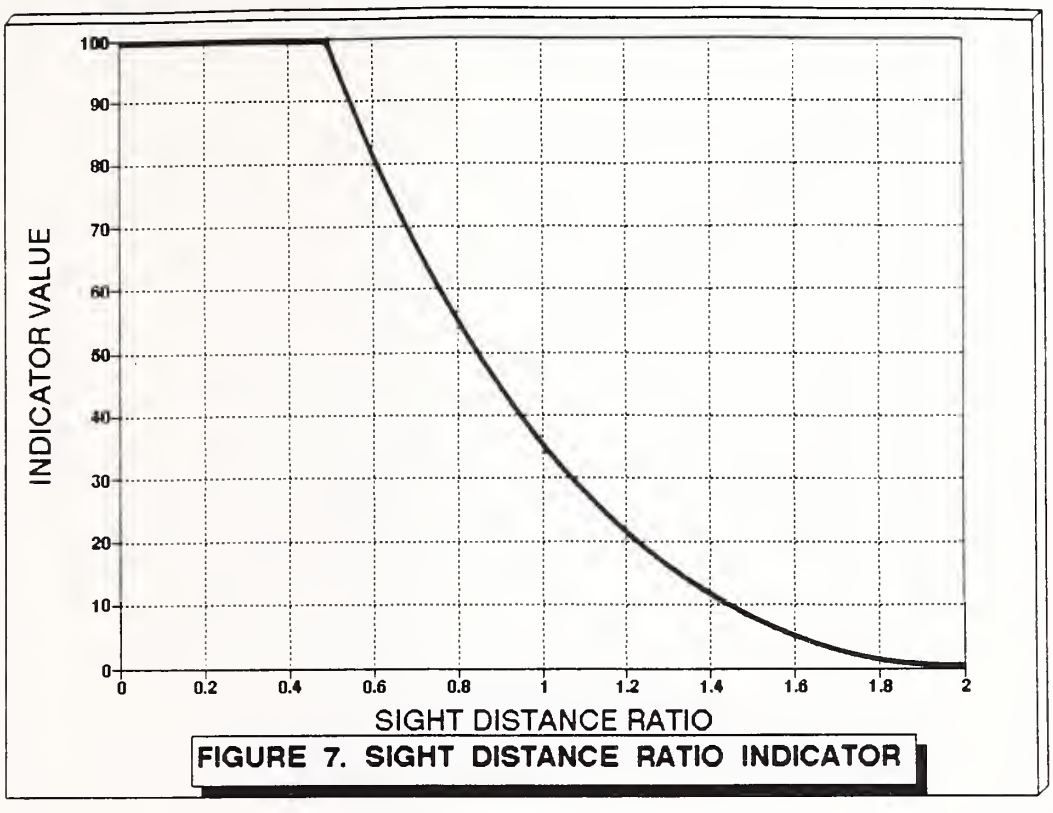


FIGURE 7. SIGHT DISTANCE RATIO INDICATOR

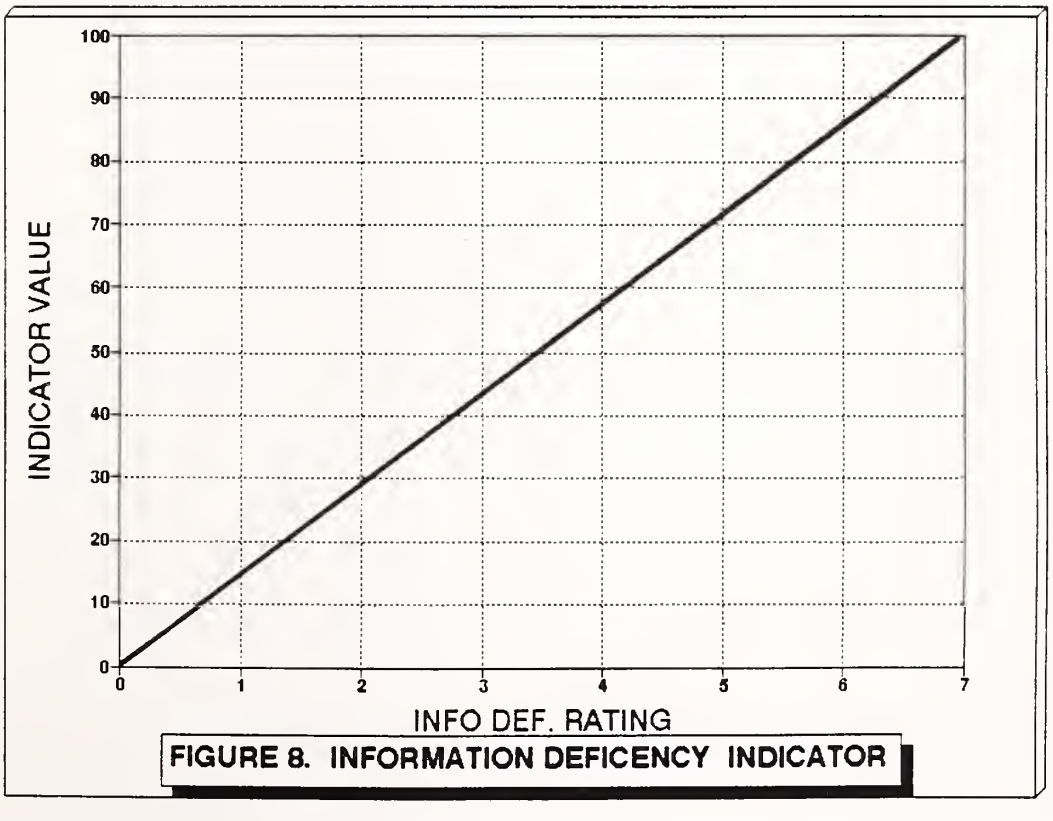


FIGURE 8. INFORMATION DEFICENCY INDICATOR

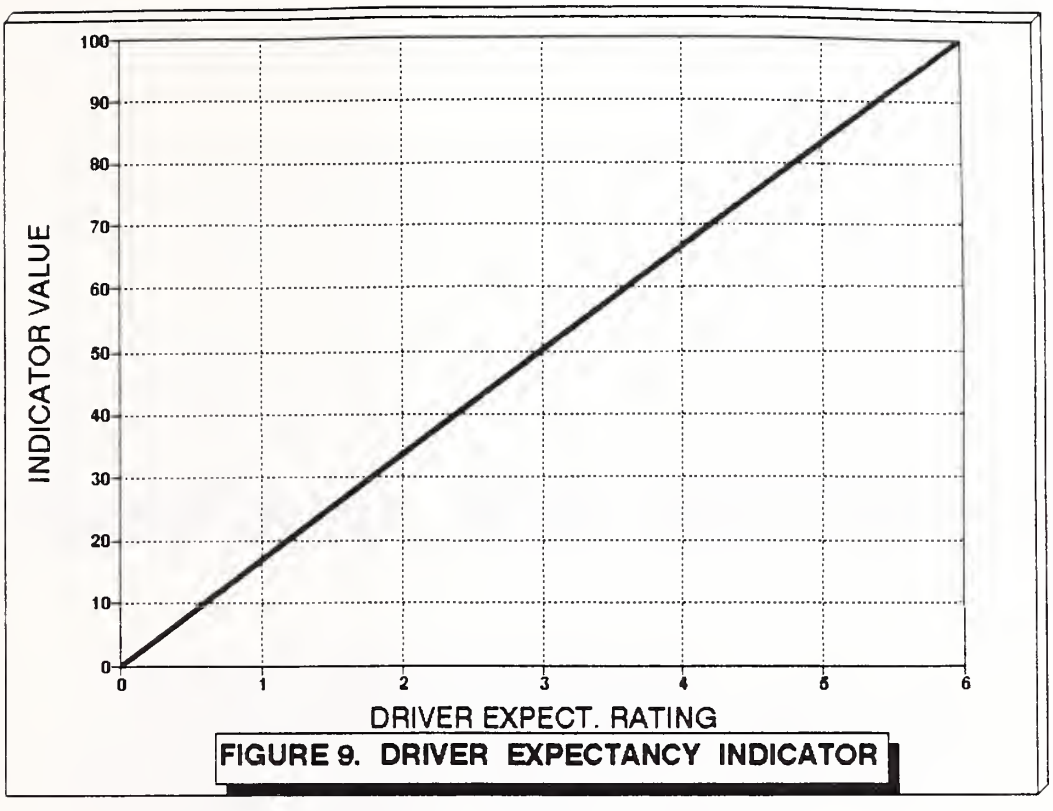


FIGURE 9. DRIVER EXPECTANCY INDICATOR

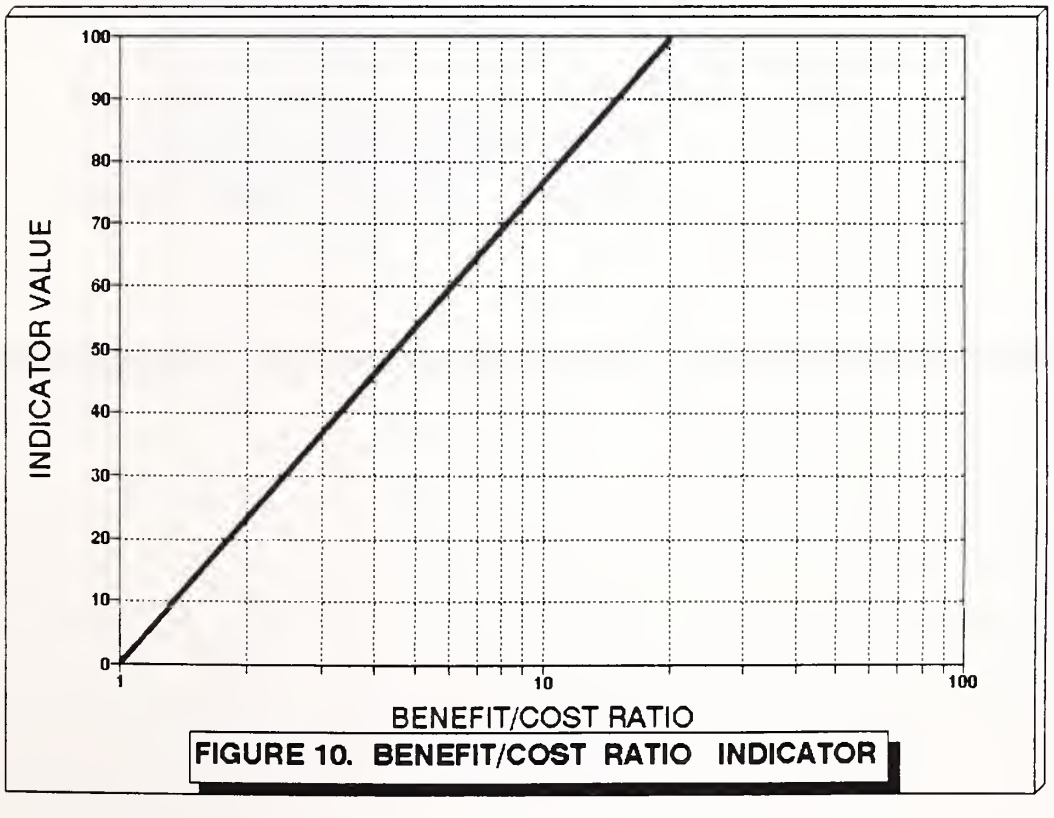
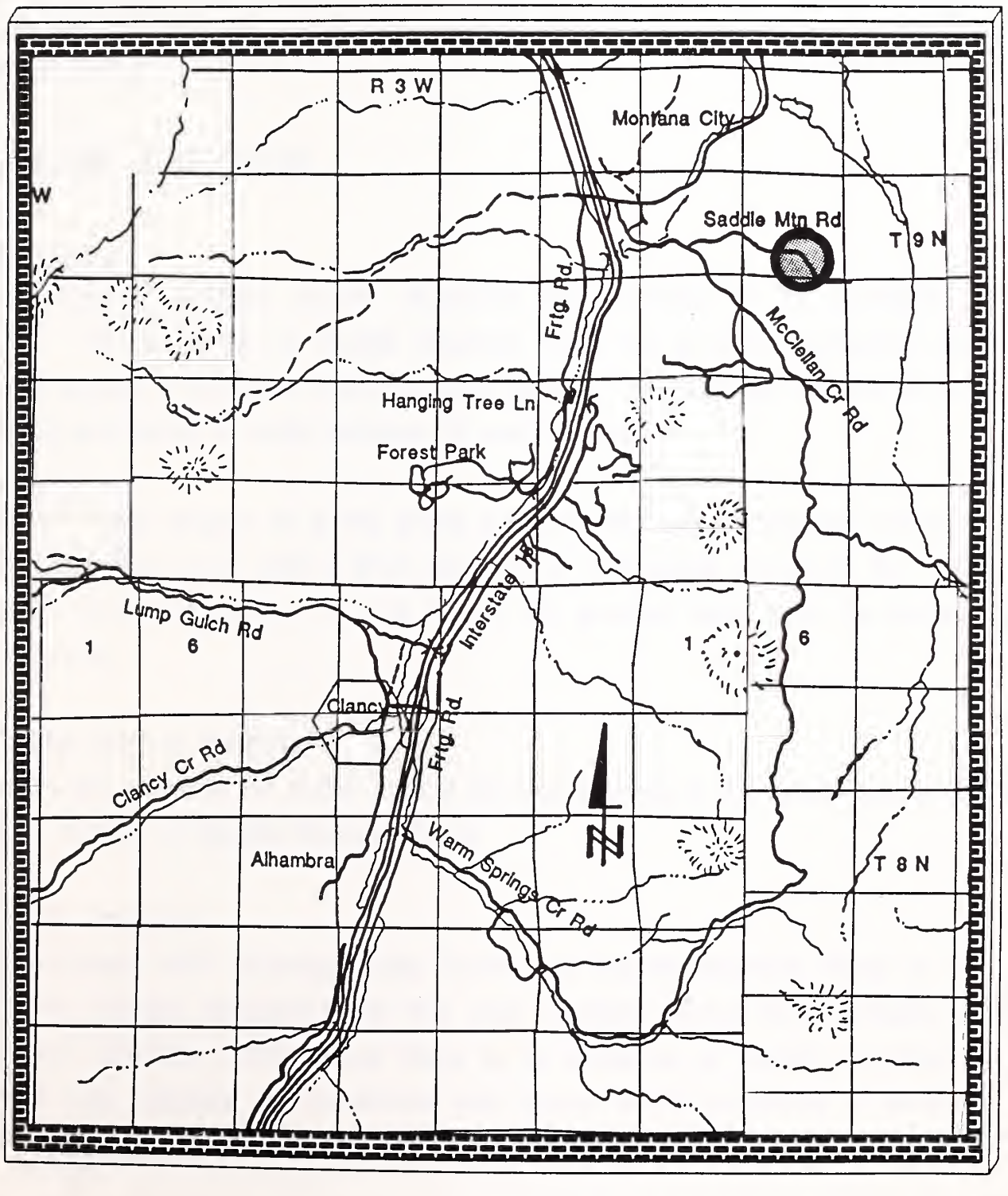


FIGURE 10. BENEFIT/COST RATIO INDICATOR

INDIVIDUAL SITE SECTIONS

1. SADDLE MOUNTAIN ROAD
2. I-15 FRTG. RD. - HANGING TREE LANE
3. CLANCY CREEK ROAD
4. WARM SPRINGS CREEK ROAD
5. PIEDMONT ROAD - KOUNTZ ROAD
6. FOREST PARK ROAD
7. LUMP GULCH ROAD, 4 MILE
8. LUMP GULCH, CLANCY FRONTAGE
9. McCLELLAN CREEK ROAD
10. CORBIN - WICKES ROAD

SADDLE MOUNTAIN ROAD
PRIORITY # 1



SADDLE MOUNTAIN ROAD

PRIORITY NUMBER 1

SITE DESCRIPTION

Saddle Mountain Road is a rural mountain road which provides access to residences and ranchettes Southeast of Helena, Montana. It begins at an intersection with McClellan Creek Road approximately 1 mile east of Interstate 15 and proceeds in an easterly direction for a distance of 1.8 to 2.0 miles. The accident cluster site is located approximately 1.2 miles east of McClellan Creek Road.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. The remainder of Saddle Mountain Road has a similar horizontal alignment except it traverses more forested terrain. The roadway surface is gravel/dirt and varies in width between 15 and 18 feet.

An extended tangent on a 4% grade precedes the sharp horizontal curve. A sharp vertical curve with a short distance of 10% grade occurs in the middle of the horizontal curve. A 4 to 5 foot tall, grassed bank is on the inside of the curve.

Traffic Control Devices

There are currently no traffic control devices existing at the study, nor on any other portion of Saddle Mountain Road,

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Saddle Mountain Road is 300. Traffic volumes throughout the five year accident period have probably remained relatively stable, since there is no evidence of recent construction. Peak hour volumes are consistent with typical hourly variations in Jefferson

County and are approximately 12 to 14% of ADT. This site was third in accident rate ranking and is one of the lower volume roads.

Traffic Operations

First impressions of the site would indicate that this section of road has a better alignment than the remainder of Saddle Mountain Road with fewer roadside obstacles. This condition is probably the primary contributing factor to accidents. The relatively tangent and flat section of road preceding the sharp horizontal and vertical curve gives the driver a false impression of the following curve. The curve is not as sharp as other curves encountered on this road, except that the bottom drops out of the road half way through. At higher speeds, little if any G force would exist between the tires and the road. This condition would certainly contribute to loss of control on the curve.

The roadway surface, as in most Jefferson County sites, has a washboard texture that provides a very uncomfortable ride at slower speeds. The rideability of the road smooths out at higher speeds, but total vehicle control and maneuverability ability is reduced significantly at higher speeds.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 3 accidents reported at this site during the 5 year period. All of the accidents were single vehicle accidents occurring at the subject curve. Two of the accidents occurred on snowy road surfaces. Only one of the accidents produced injuries. No conclusions could be drawn from the data with regard to lighting conditions.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made to reduce the effects of the operational problems noted above. advanced warning of the curve should have a better than average impact on drivers, since there are no other signs on this route. Delineators positioned through the curve area will give drivers improved perception of the combined vertical and horizontal curvature espe-

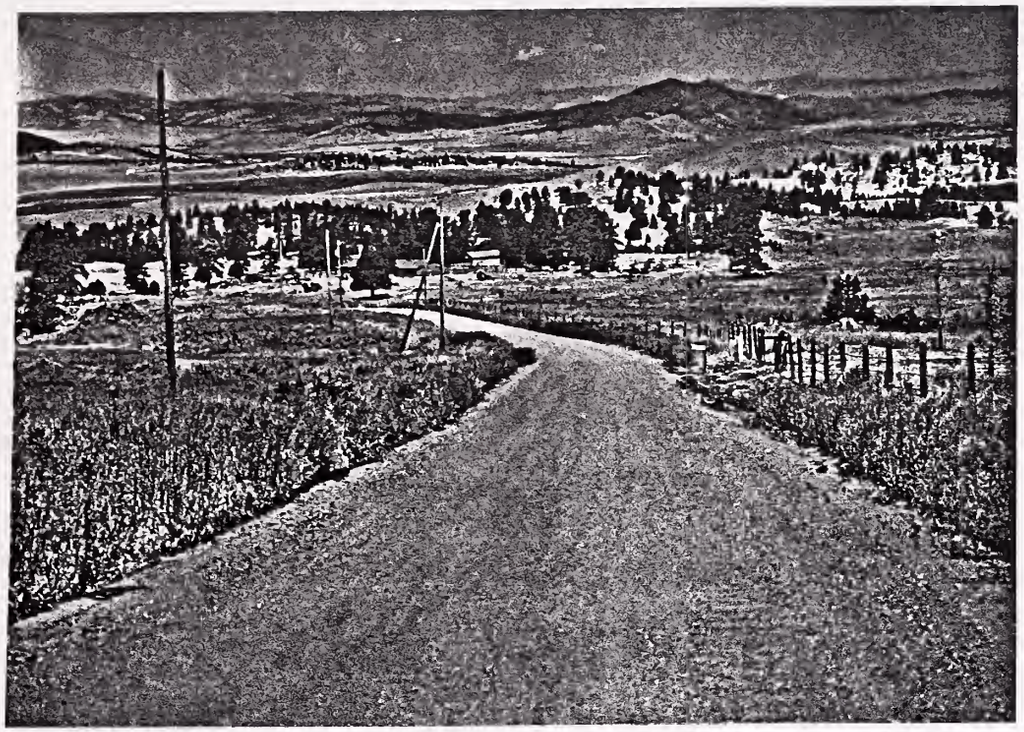
cially at night. Additional maintenance of the road surface to reduce the washboard conditions would also provide significant benefits at this location above and beyond traffic control devices.

Costs associated with the above noted improvements are estimated to be $ 440.00. This is the least costly of all the project sites and the improvements could be implemented immediately.

Long term improvements at this site would include reconstruction of the curve to flatten it and to remove the abrupt vertical curve. This solution would be costly and has the potential to move the accident problem to the next sharp curve down the road. Long term solutions should be pursued as part of a re-grading project along the entire route.

BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 4,916.00. Thus, the computed benefit/cost ratio would be 29.6, highest of all study sites.



SADDLE MTN. RD - LOOKING NORTH .2 MILE FROM CURVE

SADDLE MTN. RD - LOOKING NORTH AT CURVE

SADDLE MTN. RD - LOOKING SOUTH .2 MILE FROM CURVE

SADDLE MTN. RD - LOOKING SOUTH AT CURVE

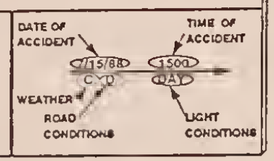
ACCIDENT TYPES

- REAR END
- HEAD ON
- SIDE SWIPE
- OUT OF CONTROL
- LEFT TURN
- ANGLE

ACCIDENT DATA LEGEND

SYMBOLS

- VEHICLE PATH
- PEDESTRIAN PATH
- BACKING VEHICLE
- PARKED VEHICLE
- FIXED OBJECT
- INJURY ACCIDENT
- FATAL ACCIDENT



ACCIDENT STATISTICS

SAWMILL ROAD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR		1	1	1		3

ACCIDENT TYPE	OFF RO.	ANG	HED ON	SDE SWP	HEAD ENG	OTHER
	0					

WEATHER	C	CL	R	S	F
	2	1			

ROAD CONDITION	D	W	I	S
	1			2

LIGHT CONDITION	DAY		NITE
	2		1

SEVERITY	POD		INJ	FATA
	2		1	

ALCOHOL INVOLVED	YES	NO
	0	3

SCALE: 1" = 100'

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	EXISTING CONDITIONS	SADDLE MTN ROAD

FIGURE NO.

SADDLE MOUNTAIN ROAD — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	1	2	60%	0.6	1.2
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	1	2	***	0.6	1.2

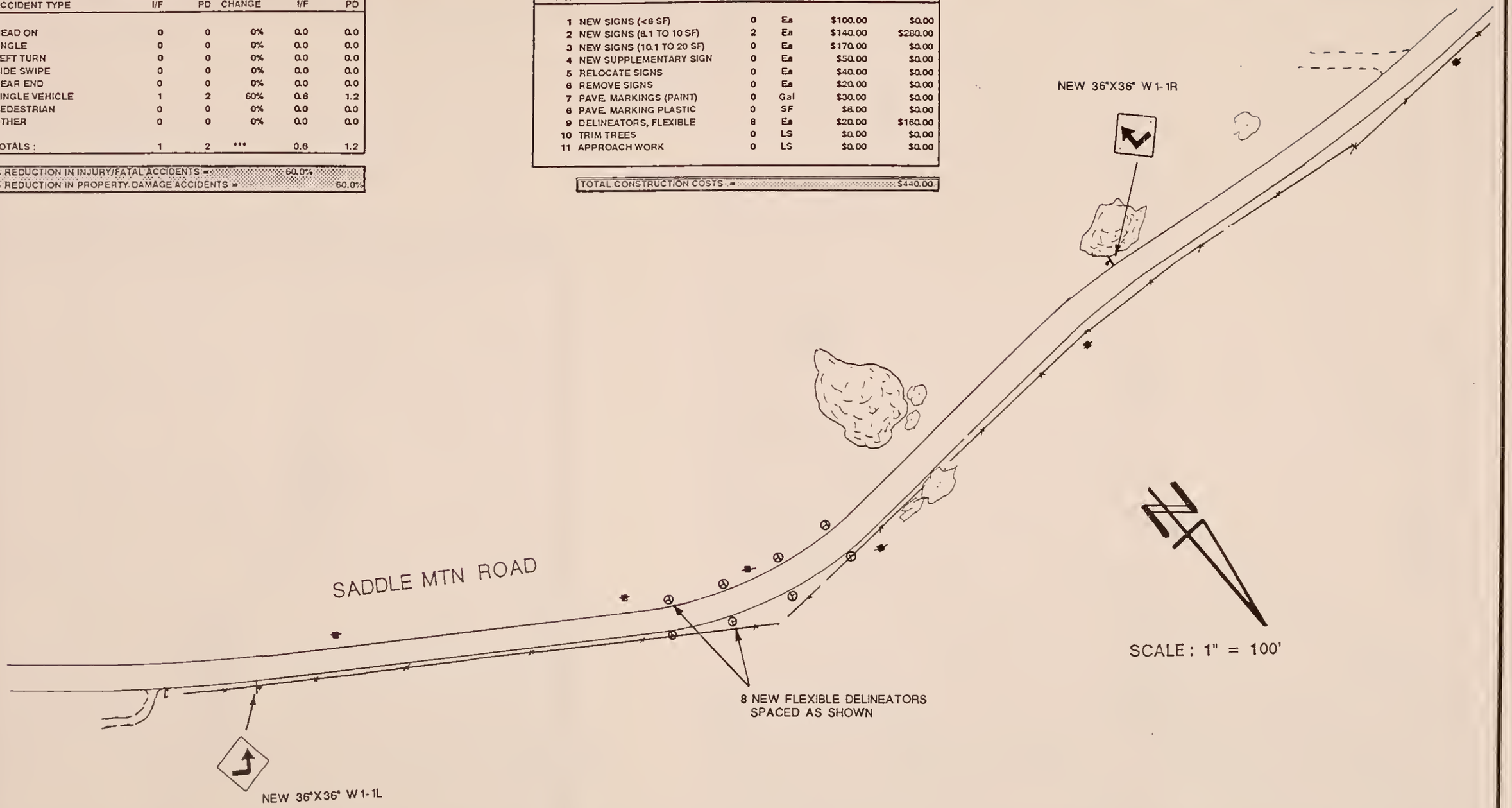
% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%

% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 60.0%

SADDLE MOUNTAIN ROAD — COST ESTIMATE

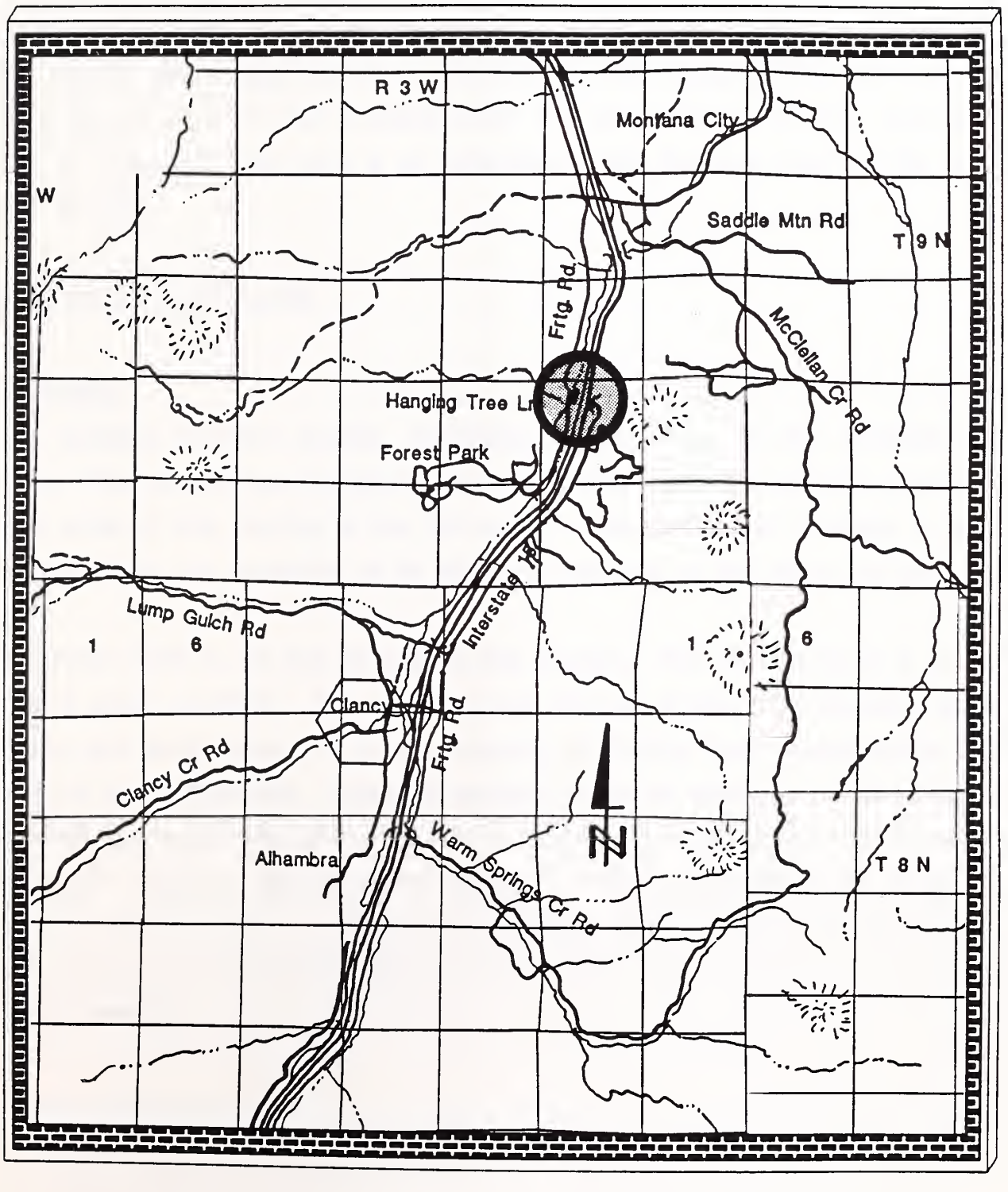
ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	2	Ea	$140.00	$280.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	0	Ea	$50.00	$0.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	0	Ea	$20.00	$0.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$8.00	$0.00
9	DELINEATORS, FLEXIBLE	8	Ea	$20.00	$160.00
10	TRIM TREES	0	LS	$0.00	$0.00
11	APPROACH WORK	0	LS	$0.00	$0.00

TOTAL CONSTRUCTION COSTS = $440.00



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5868	SHORT TERM IMPROVEMENTS	SADDLE MTN ROAD	FIGURE NO.

I-15 FRONTAGE ROAD
PRIORITY # 2



I-15 FRONTAGE ROAD @ SADDLE TREE LANE

PRIORITY NUMBER 2

SITE DESCRIPTION

I-15 Frontage Road runs parallel to Interstate 15 from the Montana City Interchange south of Helena through the Prickly Pear Creek Canyon to a point south of Montana City. The frontage road used to be part of a primary highway route on a similar alignment. The frontage road is used to provide access to the many residences and small communities along the I-15 route. At the cluster site, it approaches an intersection with Hanging Tree Lane on the west side of I-15. It then crosses under I-15 and remains on the east side of I-15. Hanging Tree Lane is an extension of the frontage road on the west side of I-15.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. The sketch has limitations since it cannot show the reverse curve on both ends of this section to the full extent. This section of frontage is quite different from the remainder of its alignment because of the sharp curves.

Roadway width is 24 feet throughout the section. The road surface is paved and in good condition. The typical cross section of the road includes steep banks and backslopes. A bridge crossing of Prickly Pear Creek exists just west of the intersection. Guardrail sections exists on each side of the bridge. A small approach road intersects the frontage road in the middle of the northern curve. This is a farmstead type access. Directly opposite it is a wide approach used for road maintenance stockpiles and parking for people who gain access to recreational uses of Prickly Pear Creek. Grades are as shown on the sketch.

Traffic Control Devices

Existing traffic control devices consist of warning signs for the reverse curve, with advisory speed plates, deer crossing and school bus stop. Arrow panels are in place at the two major curves, but one is obscured by brush. A stop sign on Hanging Tree Lane is partially hidden by a directional guide sign which is placed approximately fifty feet south of the intersection. The guide sign is supposed to be seen by frontage road traffic, but it can't be seen until a driv-er driver has already turned onto Hanging Tree Lane.

Pavement markings are vivid and applied correctly. Delineators are replete along the guardrail section of the bridge, but are sparse on the curve sections.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on I-15 Frontage Road is 1,650 currently. Traffic volumes throughout the five year accident period have actually decreased somewhat. An average over the five year period would be slightly in excess of 1,700 ADT. The typical hourly variations for this site indicate that peak hour traffic would be 13% of ADT. Turning movement volumes at this intersection are shown on the existing condition sketch. From these volumes it is apparent that Hanging Tree Lane contributes at least 50 % of the traffic on the frontage road.

Traffic Operations

This site is a classic example of a hazardous location. It has too many things happening in too short of a distance. A typical driver's conscious attention can only be directed toward two, or at best, three things at any one time. When this number is exceeded, accident probabilities become very high. In this case, there are a minimum of four conscious decision to be made from each frontage road approach: 1. Curve maneuver 2. Activity (cars & people) at the approaches 3. Alignment of vehicle over the bridge and 4. Turning movement at Hanging Tree Lane. This is all compounded by limited sight distance and the imposing visual background of Interstate 15 bridge structures.

Fortunately, most of the drivers in this area are familiar with this location and adjust their speed and attentions on the most critical conditions. It was observed that most vehicles were traveling at reasonable speeds through this area and no serious conflicts were noted. Drivers unfamiliar with the site have a higher probability of getting into an accident because approach sections of the frontage road on both ends of this site can be driven comfortably at speeds of 55 mph and greater.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 9 accidents reported at this site during the 5 year period. The most predominant accident was the single vehicle accident. Three of them were on the frontage road curve, three involved driving past the stop sign and two occurred in negotiating the turn onto Hanging Tree Lane. The typical accident was on a clear day on dry roads. Only two of the accidents produced injuries. No conclusions could be drawn from the data with regard to lighting conditions except that the accident rate was slightly higher during the daylight hours.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made to compensate for the effects of the operational problems noted above and to correct some of the problems with existing traffic control devices.

Since this site involves multiple conditions requiring the driver's conscious decisions and little can feasibly be done to physically alter the site, warning and guidance must be directed on a priority basis. The first and most important hazard is the reverse curve alignment, which has a safe comfortable speed of 25 mph. Advanced warning of this condition must be proper for the conditions encountered, therefore the multiple curve sign shall replace the revers turn sign and shall be located in advance of the first curve in the section. Delineation of the curves should be supplemented by chevrons appropriately placed and brush should be trimmed in front of the existing arrow panels.

The school bus stop ahead sign is not warranted since the stop is visible for 500 feet in advance and its existence distracts from more critical devices. This is a situation where some other arrangements should be made for the school bus stop which would not require it to load or unload children anywhere near this site.

Advance intersections warning signs with supplementary street name plates are the second most important devices in this situation. Prior warning of the intersection, along with the name of the intersecting street will tell thru traffic that there will be potential conflicts from the side and it will inform motorists intending to access Hanging Tree Lane that the intersection is directly ahead.

The existing misplaced guide sign should be removed and standard guide signs should be installed not more than 200 feet from the intersection on the frontage road approaches.

Hanging Tree Lane approach traffic will be served by installation of an oversized stop sign, a bidirectional arrow panel and a stop ahead warning sign.

Costs for the above noted improvements are estimated at $2,740.00. Almost all of these costs would be eligible for MDOH off-system safety funds.

Long term improvements at this site would be prohibitive from a cost standpoint. Topographic restrictions in the area provide little chance for realignment.

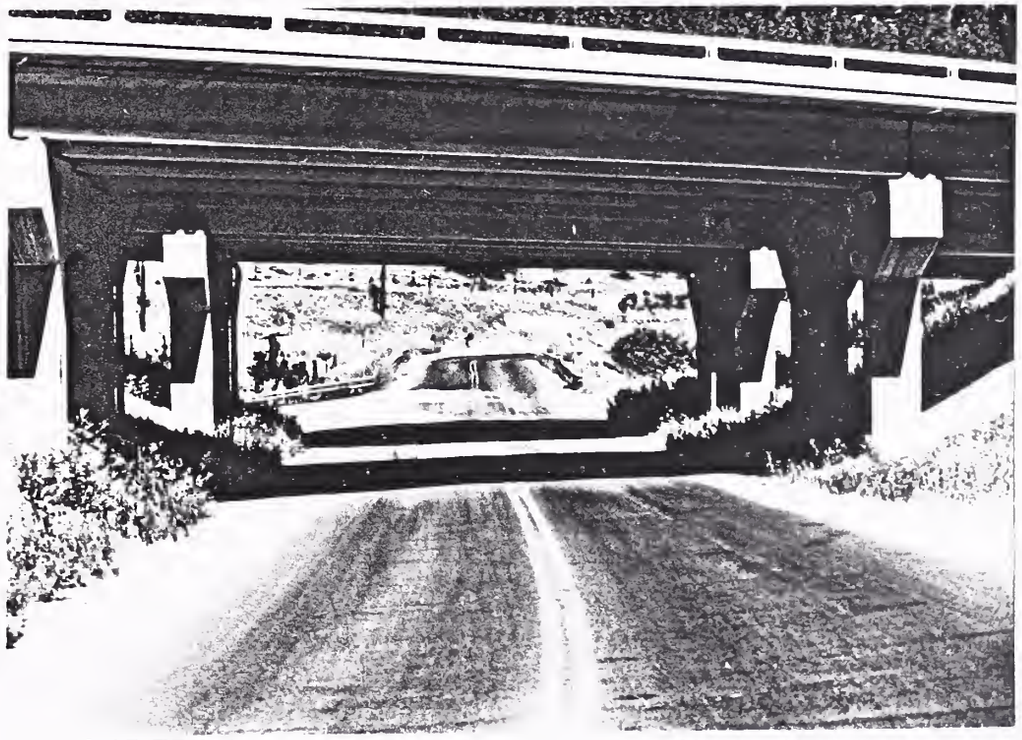
BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 10,297.00. Thus, the computed benefit/cost ratio would be 12.51, an excellent rate of return.

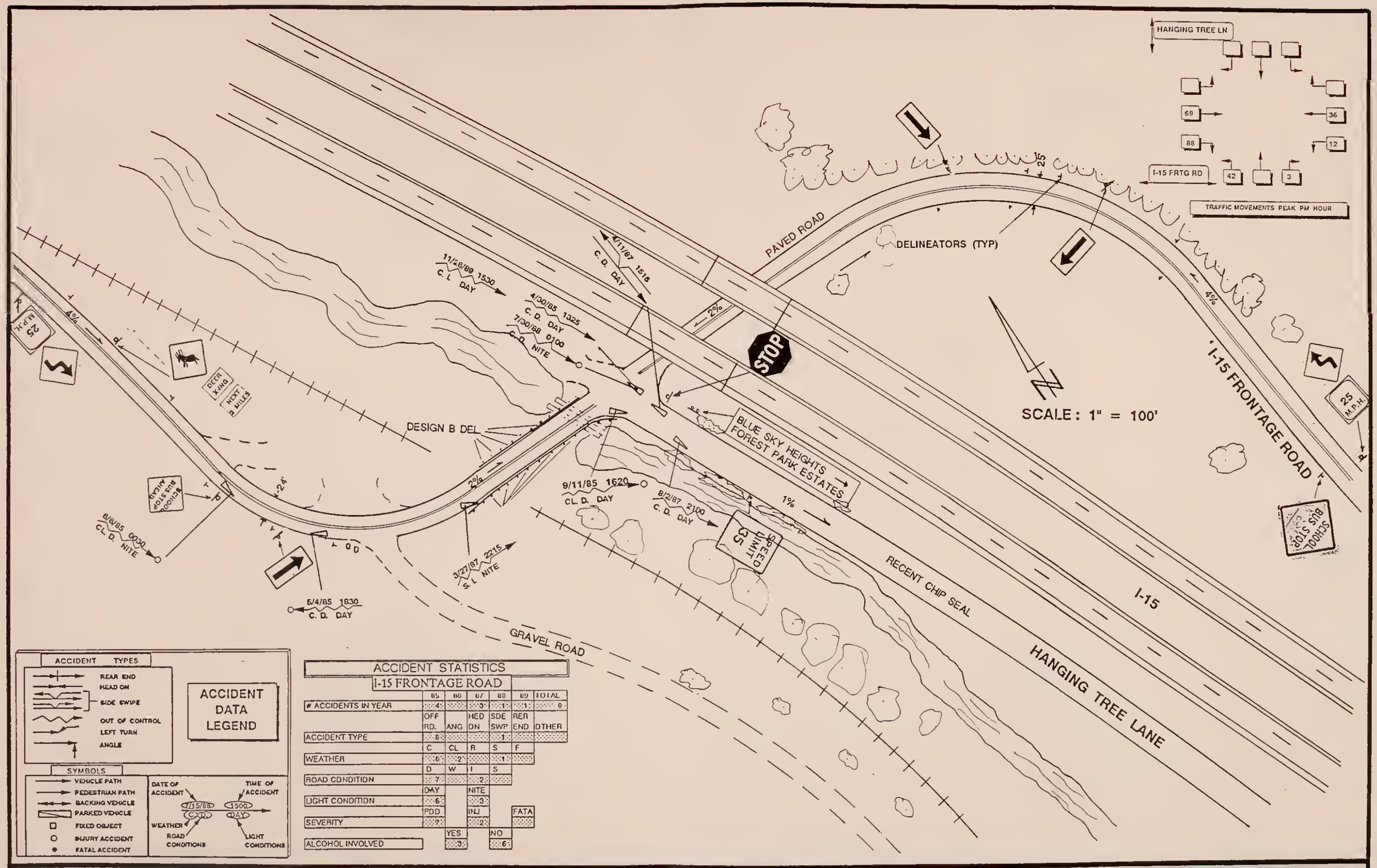
I-15 FRONTAGE ROAD SOUTH BOUND

HANGING TREE LANE N.B. APP. TO I-15 FRTG. RD.

I-15 FRONTAGE ROAD S.B. APP. TO HANGING TREE LN



I-15 FRONTAGE ROAD N.B. APP. TO HANGING TREE LN



ACCIDENT TYPES

- REAR END
- HEAD ON
- SIDE SWIPE
- OUT OF CONTROL
- LEFT TURN
- ANGLE

ACCIDENT DATA LEGEND

SYMBOLS

- VEHICLE PATH
- PEDESTRIAN PATH
- BACKING VEHICLE
- PARKED VEHICLE
- FIXED OBJECT
- INJURY ACCIDENT
- FATAL ACCIDENT

DATE OF ACCIDENT 1/15/88 · TIME OF ACCIDENT 1500 DAY · WEATHER C · ROAD CONDITIONS D · LIGHT CONDITIONS DAY

ACCIDENT STATISTICS

I-15 FRONTAGE ROAD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR	4		3	1	1	9
ACCIDENT TYPE	OFF RD. 8	ANG	HED ON	SDE SWP 1	RER END	OTHER
WEATHER	C 6	CL 2	R	S 1	F	
ROAD CONDITION	D 7	W	I 2	S		
LIGHT CONDITION	DAY 6		NITE 3			
SEVERITY	PDO 7		INJ 2		FATA	
ALCOHOL INVOLVED		YES 3		NO 6		

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5095	EXISTING CONDITIONS	I-15 FRONTAGE ROAD	FIGURE NO.

I-15 FRONTAGE ROAD ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	1	30%	0.0	0.3
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	2	6	60%	1.2	3.6
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS:	2	7	***	1.2	3.9

% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%

% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 55.7%

REMOVE W1-3L &
NEW W1-5R 36"X36"
LOCATE POST & PLATE
625' ADVANCE OF 1ST CURVE

NEW 36"X36" W2-4
W/ SUPPLEMENT ST. NAME
(BLACK & YELLOW)

HANGING TREE LN

6 NEW 18"X24" W1-8

CUT BRUSH IN FRONT OF SIGN

REMOVE W1-3L &
NEW W1-5R 36"X36"
LOCATE POST & PLATE
625' ADVANCE OF 1ST CURVE

DELINEATORS (TYP)

MOW UNDERPASS SLOPES

NEW 48"X24" W1-7

2 NEW D1-2 30"X60"
(WHITE ON GREEN)
BLUE SKY HEIGHTS
FOREST PARK ESTATES

STOP

REMOVE &
NEW 36"X36" R1-1

BLUE SKY HEIGHTS
FOREST PARK ESTATES

REMOVE

TRIM BRUSH

SCALE: 1" = 100'

I-15 FRONTAGE ROAD

25 M.P.H.

SCHOOL BUS STOP AHEAD

REMOVE

6 NEW 18"X24" W1-8

SPEED LIMIT 35

I-15

HANGING TREE LANE

NEW 36"X36" W3-1A

NEW 36"X36" W2-4
W/ SUPPLEMENT ST. NAME
(BLACK & YELLOW)

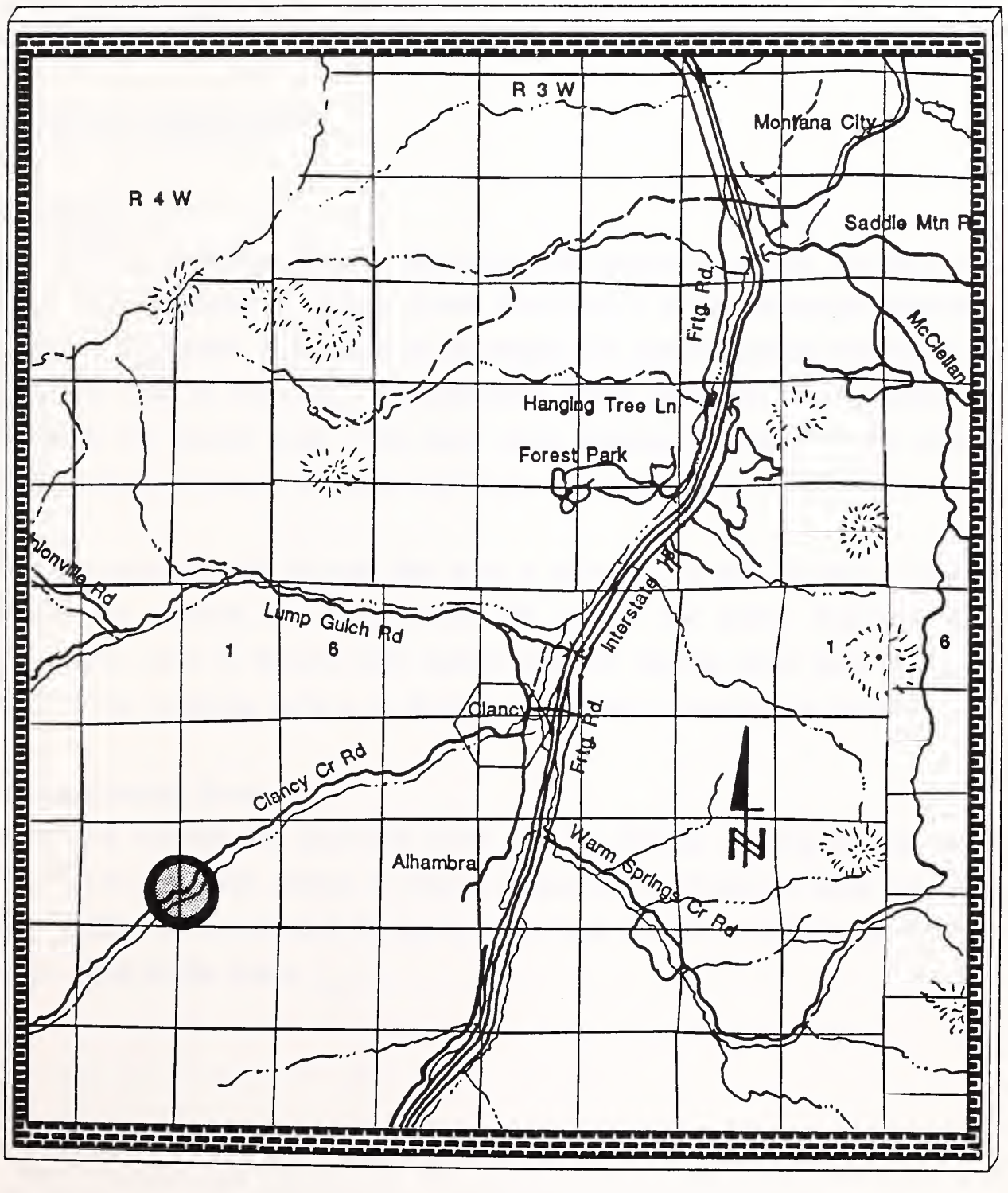
I-15 FRONTAGE ROAD COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	12	Ea	$100.00	$1,200.00
2	NEW SIGNS (6.1 TO 10 SF)	7	Ea	$140.00	$980.00
3	NEW SIGNS (10.1 TO 20 SF)	2	Ea	$170.00	$340.00
4	NEW SUPPLEMENTARY SIGN	2	Ea	$50.00	$100.00
5	RELOCATE SIGNS	2	Ea	$40.00	$80.00
6	REMOVE SIGNS	2	Ea	$20.00	$40.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$6.00	$0.00
9	DELINEATORS, FLEXIBLE	0	Ea	$20.00	$0.00
10	TRIM TREES	1	LS	$0.00	$0.00
11	APPROACH WORK	0	LS	$0.00	$0.00

TOTAL CONSTRUCTION COSTS = $2,740.00

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	SHORT TERM IMPROVEMENTS	I-15 FRONTAGE ROAD FIGURE NO.

CLANCY CREEK ROAD
PRIORITY # 3



CLANCY CREEK ROAD

PRIORITY NUMBER 3

SITE DESCRIPTION

Clancy Creek Road is a rural mountain road which provides access to residences and ranchettes South of Helena and west of Clancy, Montana. It begins at an intersection in Clancy just west of Interstate 15 and proceeds in an south westerly direction for a distance of approximately 13 miles. It intersects a system of other mountain roads and ends near the divide.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. The remainder of Clancy Creek Road has a similar horizontal alignment. It follows the Creek along most of its length with steeply sloped mountains on the other side of the road. An extremely sharp horizontal curve marks the center of the cluster area. The curve even appears sharper than the sketch would indicate because of rocks and trees that intrude into the shoulder.

Normal roadway width through this area is between 18 and 19 feet. Vertical grades are variable, but mostly under 2% at any one point. Superelevation around the curve is reverse with outside shoulder dipping down lower than the inside. The roadway surface is dirt/gravel and has a washboard texture.

Traffic Control Devices

There are currently no standard traffic control devices existing at the study site nor on any other portion of Clancy Creek Road. However, local residents have apparently considered the curve to be bad enough to tack home made curve signs to the trees.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Clancy Creek Road is 250. Traffic volumes throughout the five year accident period have probably remained relatively stable, since there is no evidence of recent construction. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT. This site was the top ranked site in accident ranking and is one of the lower volume roads.

Traffic Operations

First impressions of this site indicate that this section of road is vastly different from the remainder of Clancy Creek Road. Numerous curves in the winding road are encountered, but this curve is significantly sharper with more roadside obstacles than at any other location. Unfortunately, the drivers are in the middle of the curve before the realization sets in. This condition is probably the primary contributing factor to accidents at this site.

Relatively flat and tangent sections of road preceding the sharp horizontal curve gives the driver a false impression of the following curve. The reverse superelevation of the road makes this curve unforgiving when a vehicle has entered the curve at an excessive speed. To compound the problem, the roadside intrusions narrow the vehicle path and it is difficult for two passenger cars to pass within the curve area.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 4 accidents reported at this site during the 5 year period. All but one of the accidents were single vehicle accidents occurring at the subject curve. The other accident was a head on collision in the middle of the curve. Three of the accidents occurred on icy road surfaces. Only one of the accidents produced injuries. The accident rate at night was much greater than in the daylight hours which indicates that the conditions are severe enough that even motorists familiar with the curve, have a difficult time perceiving the situation with poor lighting conditions.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made to reduce the effects of the operational problems noted above. Advanced warning of the curve should have a better than average impact on drivers, since there are no other signs on this route. However, physical barriers at this site are so severe that traffic control devices alone would not significantly reduce the potential for accidents. The roadside intrusions must be removed and proper superelevation must be graded into the road cross section. This would involve cutting into the rock slope approximately 2 to 4 feet and forming a ditch section off the inside shoulder. Large trees growing in the shoulder must also be removed. The finished improvements should provide a clear roadway width of at least 20 feet with additional clear area for a ditch and shoulders.

Costs associated with the above noted improvements are estimated to be $1,980.00. Even with physical changes to the roadway this is only a medium cost within all the project sites and Jefferson County maintenance crews would be able to perform all of the necessary work.

Long term improvements at this site cannot be foreseen at this time. Once the physical changes required by short term improvements are made, this curve should be similar in nature to the remainder of Clancy Creek Road.

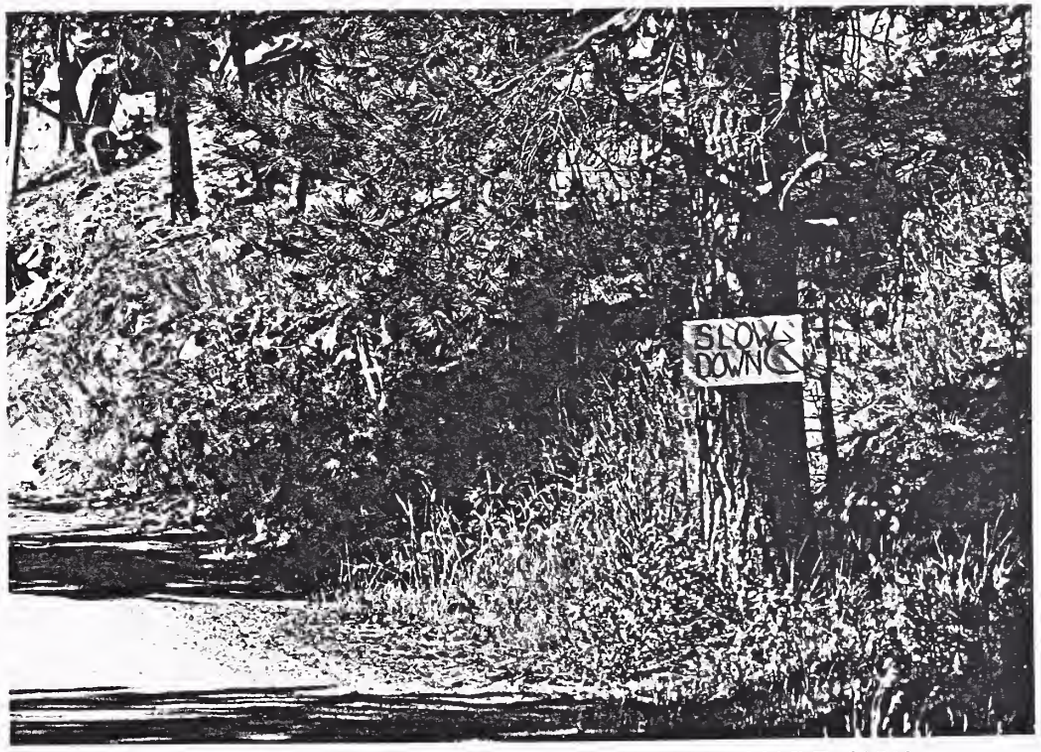
BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 5,035.00. The computed benefit/cost ratio would be 8.80, a very good rate of return for a modest investment.

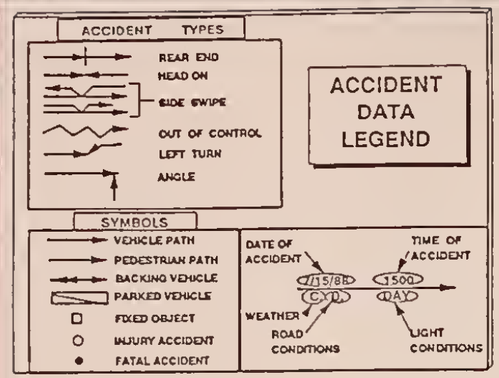
CLANCY CREEK ROAD - LOOKING N.E. 0.1 MILE FROM CURVE

CLANCY CREEK ROAD - LOOKING S.W. 0.2 MILE FROM CURVE

CLANCY CREEK ROAD - LOOKING N.E. AT CURVE



CLANCY CREEK ROAD - LOOKING S.W. HOMEMADE SIGN



ACCIDENT STATISTICS
CLANCY CREEK ROAD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR	1	1	1	1		4

	OFF RD.	ANG	HED ON	SOE SWP	RER END	OTHER
ACCIDENT TYPE	2		1		1	

	C	CL	R	S	F
WEATHER	1	2	1		

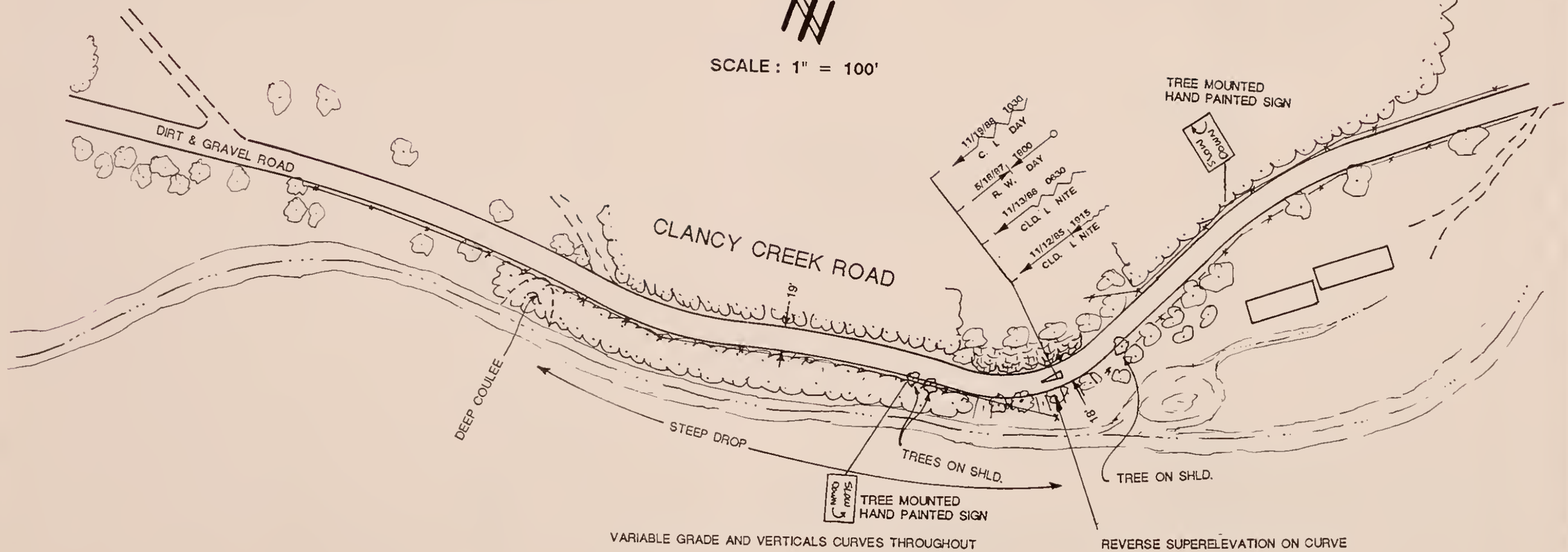
	D	W	I	S
ROAD CONDITION		1	3	

	DAY	NITE
LIGHT CONDITION	2	2

	POD	INJ	FATA
SEVERITY	3	1	

	YES	NO
ALCOHOL INVOLVED	0	4

SCALE : 1" = 100'



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	EXISTING CONDITIONS	CLANCY CREEK ROAD	FIGURE NO.

CLANCY CREEK ROAD — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PO	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PO
HEAD ON	1	0	60%	0.6	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	1	40%	0.0	0.4
SINGLE VEHICLE	0	2	60%	0.0	1.2
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	1	3	***	0.6	1.6

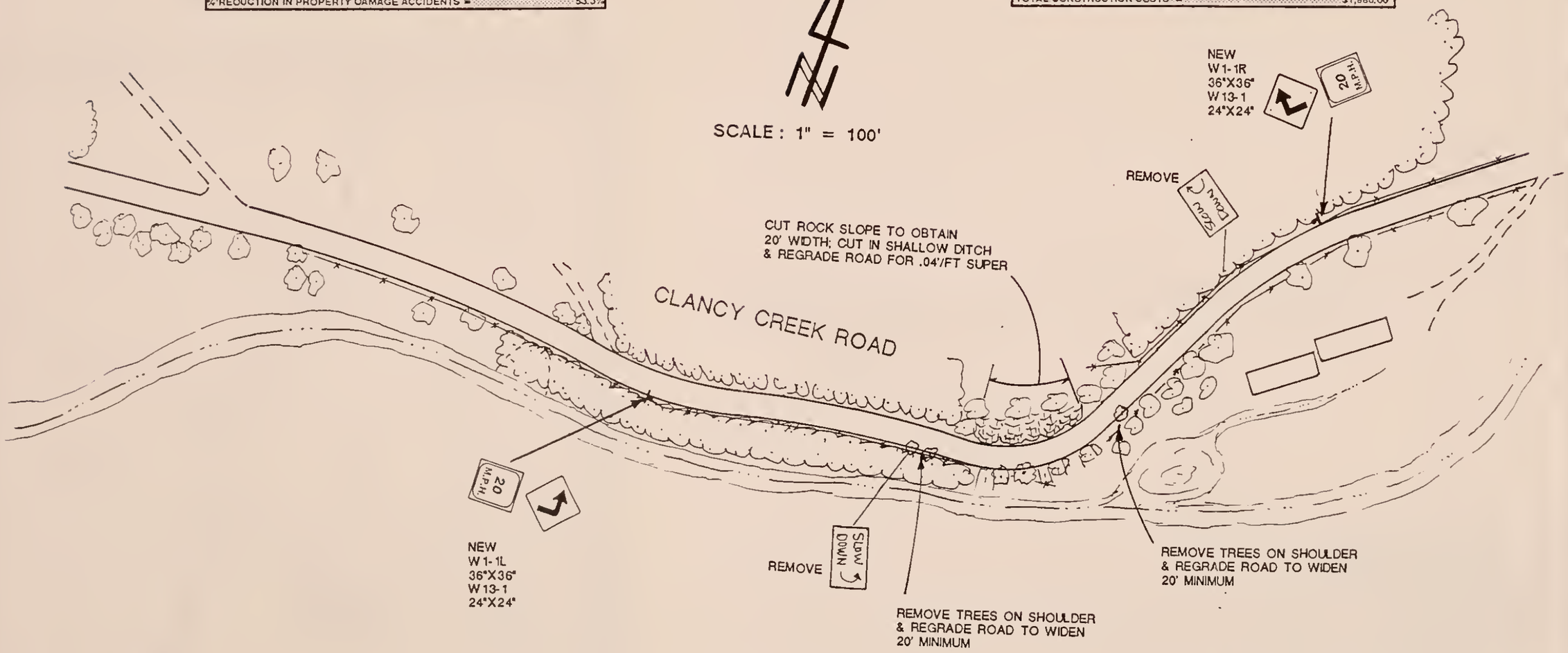
% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 53.3%

CLANCY CREEK ROAD — COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	2	Ea	$140.00	$280.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	2	Ea	$50.00	$100.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	2	Ea	$20.00	$40.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$8.00	$0.00
9	DELINEATORS, FLEXIBLE	8	Ea	$20.00	$160.00
10	TRIM TREES	1	LS	$400.00	$400.00
11	ROAD & SLOPE WORK	1	LS	$1,000.00	$1,000.00

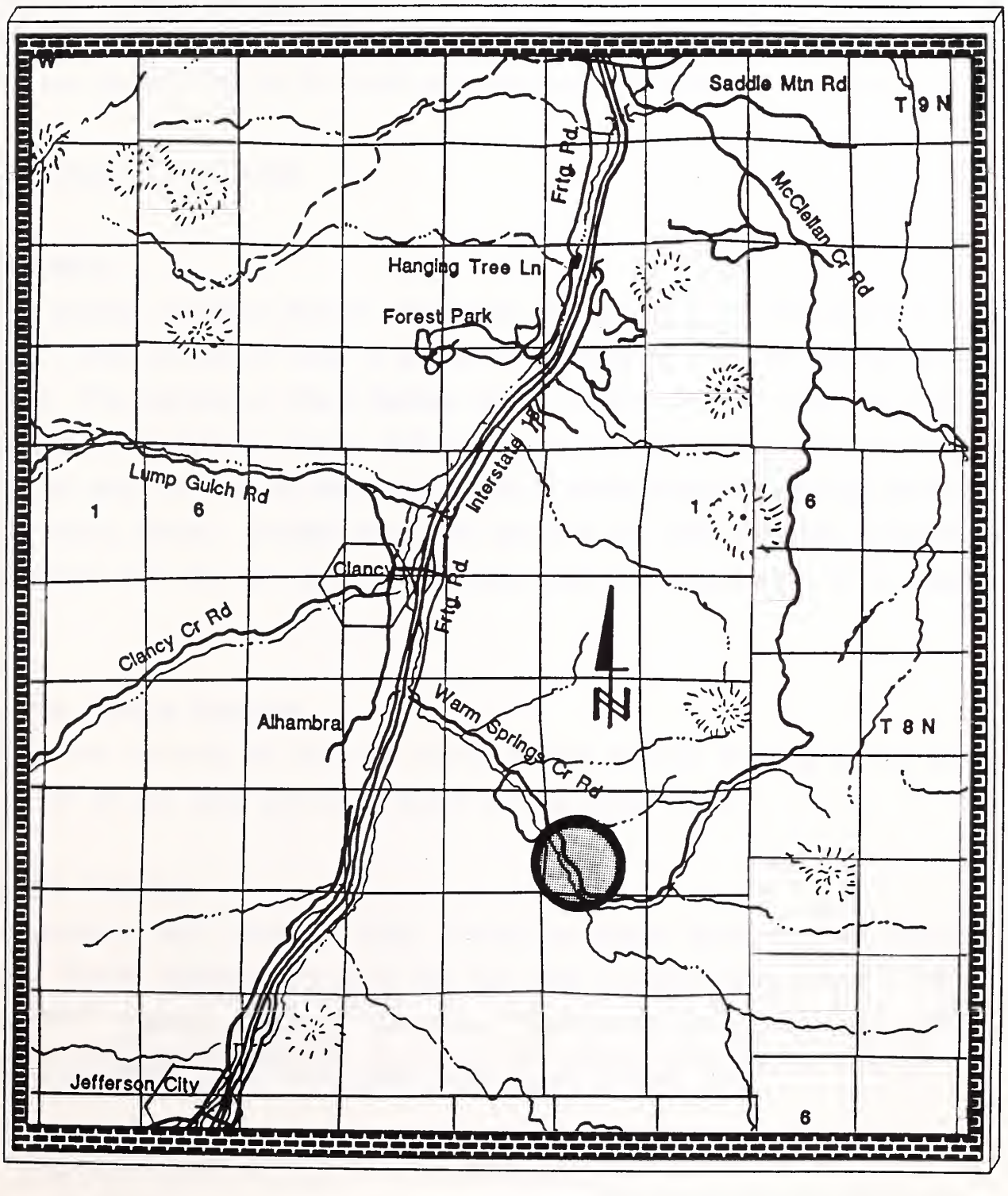
TOTAL CONSTRUCTION COSTS = $1,980.00

SCALE : 1" = 100'



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-3033	SHORT TERM IMPROVEMENTS	CLANCY CREEK ROAD	FIGURE NO.

WARM SPRINGS CREEK ROAD
PRIORITY # 4



WARM SPRINGS CREEK ROAD

PRIORITY NUMBER 4

SITE DESCRIPTION

Warm Springs Creek Road is a rural mountain road which provides access to residences and ranchettes South of Helena and east of Clancy, Montana. It begins at an intersection with I-15 Frontage on the east side of I-15 1 mile south of Clancy and proceeds in an south easterly direction for a distance of approximately 6 miles. It intersects a system of other mountain roads and one end circles back to the north and intersects McClellan Creek Road.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. This section of road is unlike the remainder of Warm Springs Creek Road. The majority of Warm Springs Creek Road is 22 feet wide and has an alignment that follows clearly defined curves and tangents. This section of road is only 14' wide in some spots and it winds, snakelike through boulders and heavy forest. Grades along this sections are also variable. Alignment combined with the dirt surface give this road the appearance of a logging road.

Traffic Control Devices

There are currently no standard traffic control devices existing at the study site nor on any other portion of Warm Springs Creek Road.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Warm Springs Creek Road is 200. Traffic volumes throughout the five year accident period have probably remained relatively stable. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of

ADT. This site was the second ranked site in accident ranking and is the lowest volume roads of all study sites.

Traffic Operations

First impressions of this site indicate that this section of road is vastly different from the remainder of Warm Springs Creek Road. Numerous curves in the winding road are encountered. Lack of coordination between vertical and horizontal curves causes frequent loss of sight distance and road alignment disorientation. Extreme encroachments by trees and rocks along the narrow road provides very little room for error in vehicle maneuvers, and makes it all but impossible for two vehicles to pass.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 3 accidents reported at this site during the 5 year period. All of the accidents were single vehicle accidents occurring along the cluster area. Two of the accidents involved collisions with roadside obstacles and one involved loss of control on a curve. Two of the accidents occurred on wet or snowy road surfaces. Two of the accidents produced injuries making this site number one in severity. The accident rate at night was much greater than in the daylight hours which indicates that the conditions are severe enough that even motorists familiar with the road, have a difficult time perceive the conditions in poor lighting conditions.

SHORT TERM IMPROVEMENTS

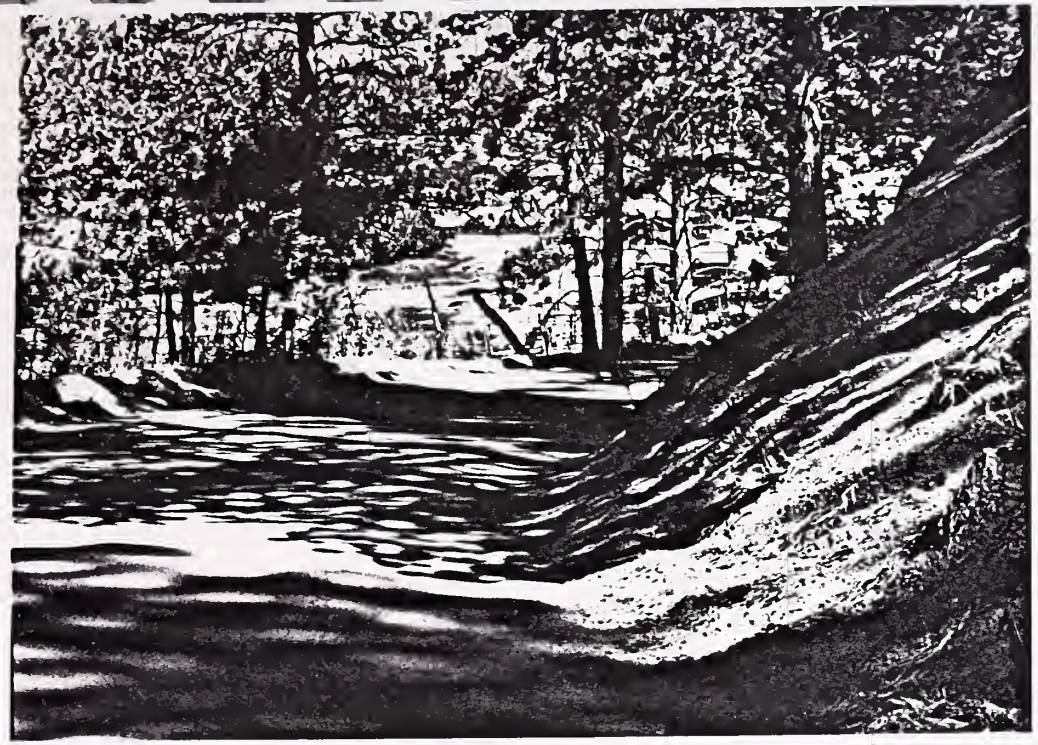
Suggested improvements at this site are made to reduce the effects of the operational problems noted above. Advanced warning of the winding curves should have a better than average impact on drivers, since there are no other signs on this route. However, physical barriers at this site are so severe that traffic control devices alone would not significantly reduce the potential for accidents. The roadside intrusions must be removed; small variations in the road alignment could be graded out; and the road surface should be widened to at least 20 feet.

Costs associated with the above noted improvements are estimated to be $2,940.00. Even with physical changes to the roadway this is only a medium cost within all the project sites and Jefferson County maintenance crews would be able to perform all of the necessary work.

Long term improvements at this site cannot be foreseen at this time. Once the physical changes required by short term improvements are made, this curve should be similar in nature to the remainder of Warm Springs Creek Road.

BENEFITS

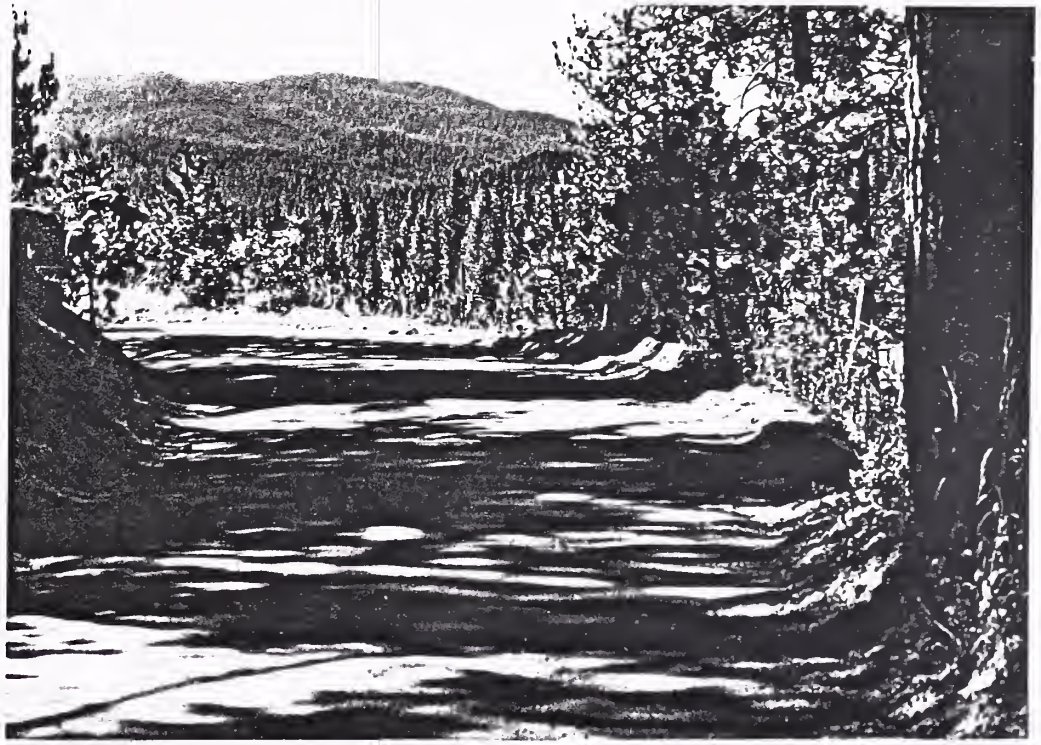
Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 9,281.00. The computed benefit/cost ratio would be 11.24, one of the higher B/C ratios of all the study sites.



WARM SPRINGS CR RD - LOOKING N.W. MID SECTION

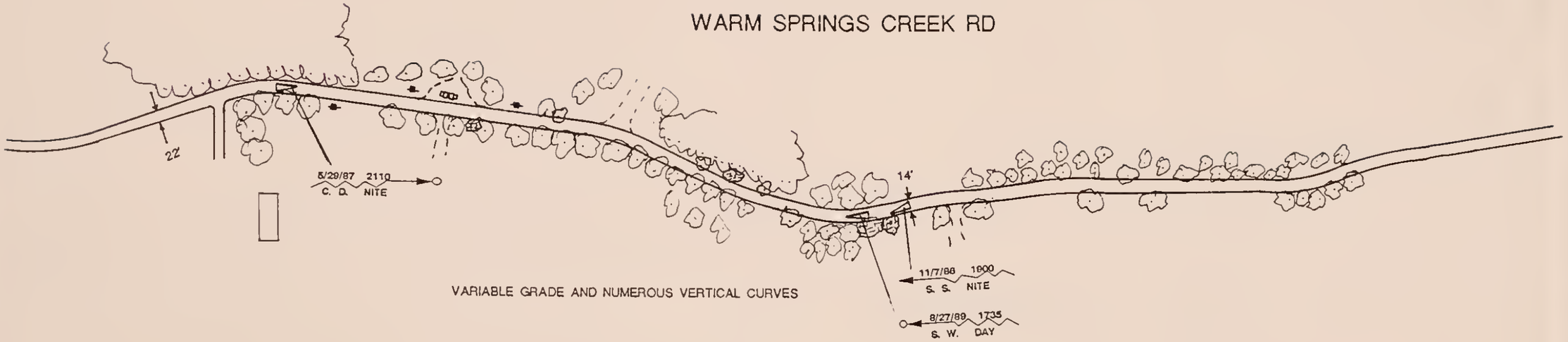
WARM SPRINGS CR RD - LOOKING S.E. MID SECTION

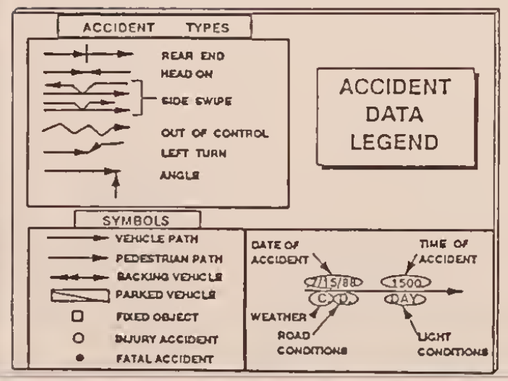
WARM SPRINGS CR RD - LOOKING N.W. SOUTH END



WARM SPRINGS CR RD - LOOKING S.E. SOUTH END

SCALE: 1" = 200'





ACCIDENT STATISTICS

WARM SPRINGS CR RD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR		1	1		1	3
ACCIDENT TYPE	OFF RD. 3	ANG	HED ON	SDE SWP	RER END	OTHER
WEATHER	C 1	CL	R	S 2	F	
ROAD CONDITION	O 1	W 1	I	S 1		
LIGHT CONDITION	DAY 1		NITE 2			
SEVERITY	PDO 1		INJ 2		FATA	
ALCOHOL INVOLVED		YES 1		NO 2		

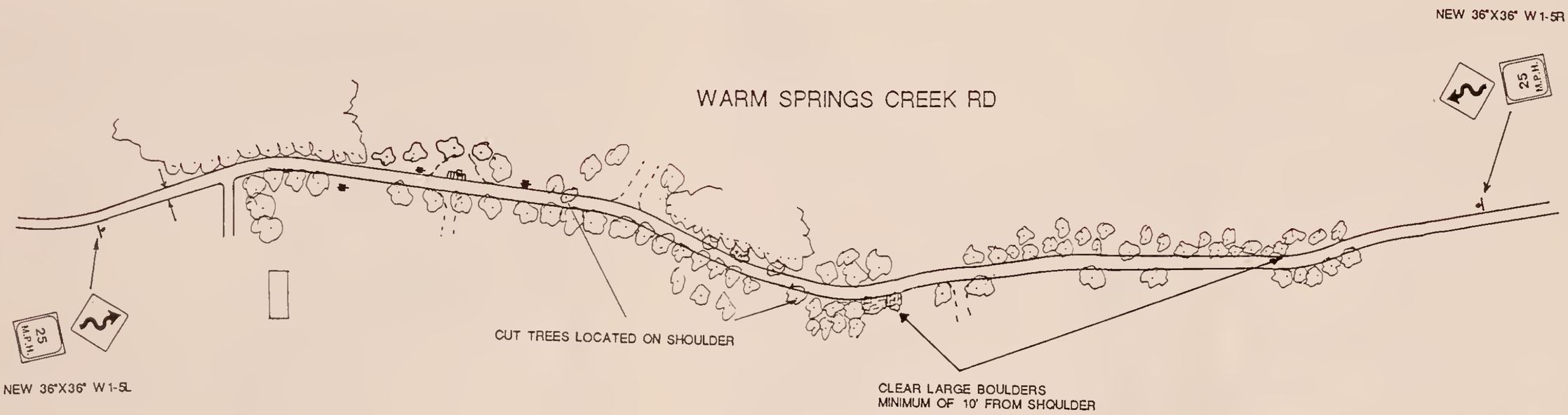
DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	EXISTING CONDITIONS	WARM SPRINGS CREEK RD FIGURE NO.

SCALE: 1" = 200'

WARM SPRINGS CR. RD. ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	2	1	60%	1.2	0.6
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	2	1	***	1.2	0.6

% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 60.0%



REGRADE ROAD TO ELIMINATE SHORT VERTICAL CURVES
AND TO WIDEN ROADWAY, MINIMUM WIDTH OF 20'
ESTIMATE INCLUDES 3 DAYS OF GRADER AND EQUIPMENT USE.

WARM SPRINGS CR. ROAD COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	2	Ea	$140.00	$280.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	2	Ea	$50.00	$100.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	0	Ea	$20.00	$0.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$8.00	$0.00
9	DELINEATORS, FLEXIBLE	8	Ea	$20.00	$160.00
10	TRIM TREES	1	LS	$600.00	$600.00
11	ROADWORK	1	LS	$1,800.00	$1,800.00

TOTAL CONSTRUCTION COSTS = $2,840.00

DATE:

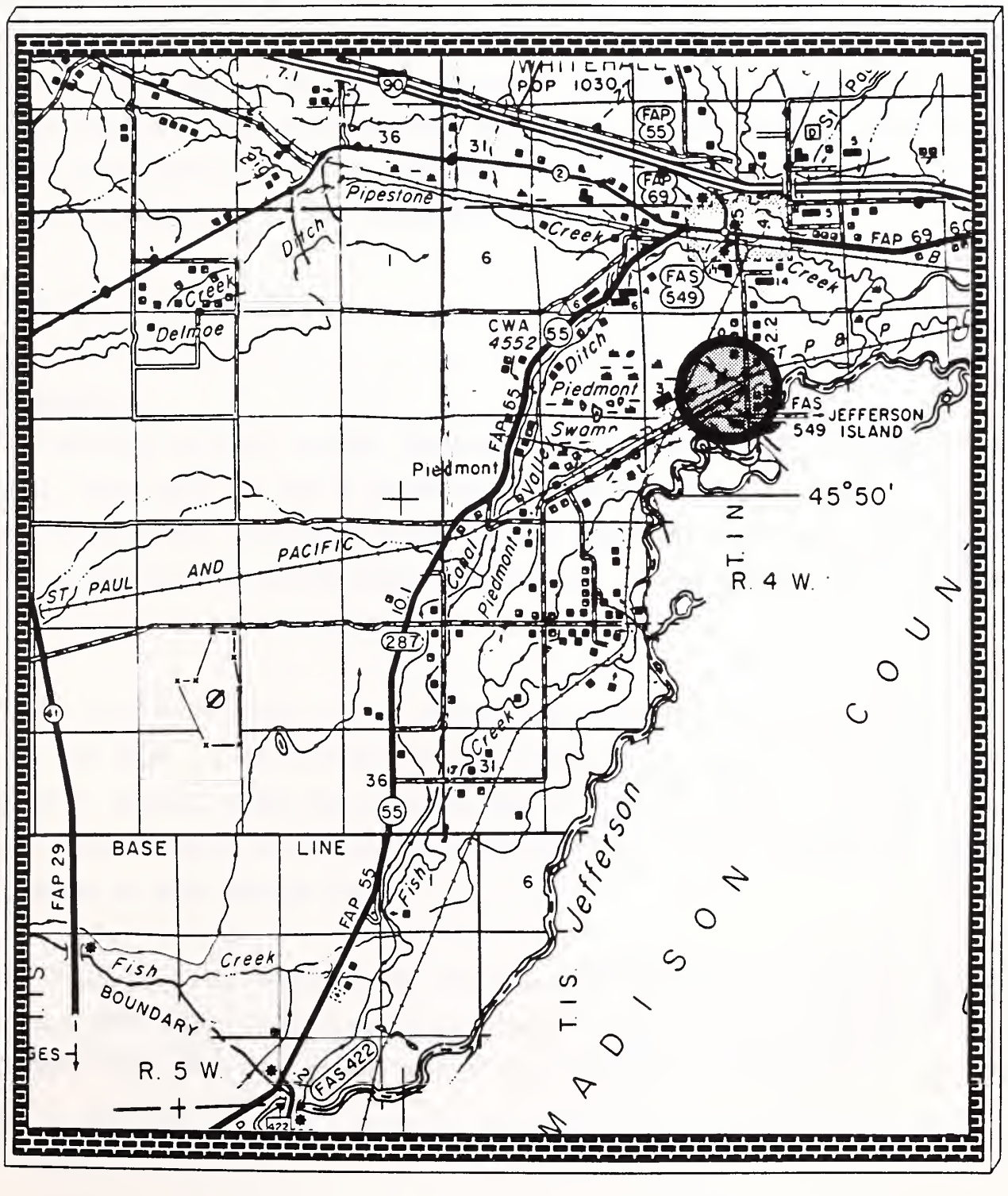
MARVIN & ASSOCIATES
Traffic, Transportation & Civil Engineers
1120 Alderson Ave
Suite 204
Billings, MT 59102
406-[illegible]

SHORT TERM IMPROVEMENTS

WARM SPRINGS CREEK RD

FIGURE NO.

PIEDMONT - KOUNTZ ROAD
PRIORITY # 5



PIEDMONT ROAD - KOUNTZ ROAD

PRIORITY NUMBER 5

SITE DESCRIPTION

Piedmont Road is a rural road which runs in a northeast by southwest direction through farm land south of Whitehall, Montana. It begins at an intersection with a north-south road two miles west of its intersection with Kountz Road and follows the alignment of the old St. Paul & Pacific railroad right-of-way.

Kountz Road, signed as Division Street in Whitehall, is a north-south road which begins at the Whitehall main street and extends south 2 miles to a curve which takes it east to Jefferson Island, another one half mile. These roads both serve farms and residences in the area.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. Both road are flat in grade and tangent in alignment. Piedmont Road has an extremely washboard gravel surface and Kountz has a gravel surface with a this layer of double penetration asphalt. The asphalt treated surface has numerous breaks and potholes.

At the intersection area a local access road intersects from the east offset from the alignment of Piedmont Road, probably in avoidance of a power pole which is located within the projected line of Piedmont Road. An eight foot high wood fence is located in the southwest corner of the intersection which encloses an auto salvage yard.

The roadside along Piedmont has sharp and shallow ditches at the shoulders edge. Both sides of both roads are fenced. There are no approaches to Piedmont Road but Kountz has several farm and house approaches.

Traffic Control Devices

Existing signing at this site consists of a stop sign on the Piedmont Road approach, which is completely hidden by the auto salvage yard fence; speed limit signs; an advanced intersection warning sign for southbound traffic; two hazard markers with the cross hatch marks pointing in the wrong direction at a culvert crossing. Not only are the hazard sign markings sloping in the wrong direction, but there is only one for each direction of travel, a serious problem for nighttime driving.

Traffic Volumes

Approximate ADT (Average Daily Traffic) entering this cluster site is 720. There has been some traffic growth in this area over the past 5 years. The average during the period, according to historical records was 600 ADT. Volumes on Kountz are approximately 500 to 600 ADT and volumes on Piedmont are 220 ADT. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT. Peak hour turning volume movements at the intersection are shown on the existing condition sketch.

Traffic Operations

The most significant problem observed at this site was the overwhelming effect of the wood fence on sight distance from all approaches. It not only blocks sight distance for approaching traffic, it completely blocks line of sight for the stop sign.

The second most obvious problem at this location is the offset intersection. Cars entering the intersection from the east appear to be coming out of nowhere and location of the exact intersection area while driving on Kountz is very difficult to perceive.

The washboard surface on Piedmont is the most severe of any of the study sites. Lack of control on this section can be very critical at higher speeds, which the tangent alignment could encourage. Road surface breaks on Kountz

Road are not severe enough to be a concern in vehicle control, but avoidance maneuvers create lane encroachment problems.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 6 accidents reported at this site during the 5 year period. All of the accidents were single vehicle accidents occurring along the cluster area. One of the accidents involved a collision with an an animal. Two accidents involved loss of control on the washboard surface. Two other accidents involved vehicles shooting through the stop sign and striking fixed objects. Only one of the accidents occurred on wet road surfaces. Three of the accidents produced injuries making this site one of the highest ranked sights in severity. The accident rate at night was the highest of any site with all but one accident occurring at night.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made to reduce the effects of the operational problems noted above. Agreements with the auto salvage lot owner will have to be made to either replace the fence with chain link at the intersection, or set the fence back out of the clear vision zone.

Reconstruction of the intersection and relocation of one power pole is necessary to simplify the intersection and to remove fixed object hazards. This will also provide more visual clues as to the location of the intersection area.

Advanced intersection warning signs with supplementary street name plates will provide drivers the opportunity to watch for conflicting traffic and to prepare for a turn in advance of the intersection.

A new oversized stop sign with street name signs should be installed at a location which provides maximum visibility. These signs should be supplemented with an advanced stop ahead warning sign to further enhance the required stop condition.

New culvert hazard markers should be correctly installed with the hash marks pointing down toward the roadway on each side of the road for each direction of approach. No hazard markers are better than just one, since one marker could easily guide a driver off the road in inclement weather conditions at night.

On Piedmont Road, the abrupt shoulder-ditch edge should be bladed flatter to eliminate the possibility of vehicles catching a wheel and loosing control. Regular maintenance to improve the washboard surface is also required.

Costs associated with the above noted improvements are estimated to be $4,280.00. This is one of the higher costs projects, but Jefferson County maintenance crews are capable of performing all of the work.

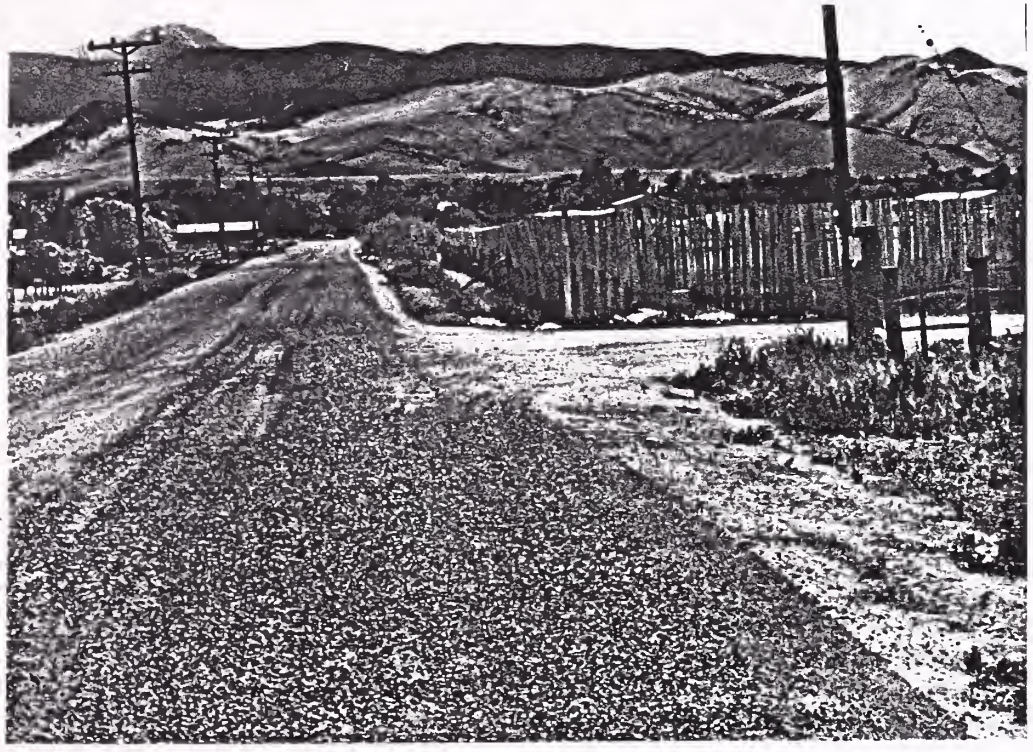
Long term improvements at this site cannot be foreseen at this time, since the physical changes required by short term improvements will eliminate a lot of future problems.

BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 14,066.00. The computed benefit/cost ratio would be 11.44, one of the higher B/C ratios of all the study sites.

KOUNTZ ROAD NORTH BOUND

PIEDMONT ROAD EAST BOUND



KOUNTZ ROAD SOUTH BOUND

PIEDMONT ROAD WEST BOUND

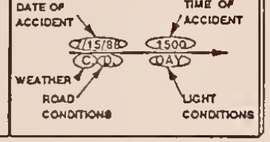
ACCIDENT TYPES

- REAR END
- HEAD ON
- SIDE SWIPE
- OUT OF CONTROL
- LEFT TURN
- ANGLE

ACCIDENT DATA LEGEND

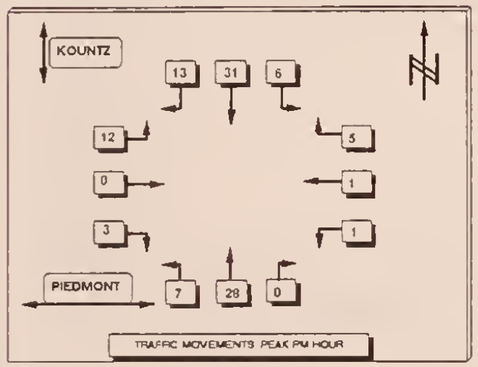
SYMBOLS

- VEHICLE PATH
- PEDESTRIAN PATH
- BACKING VEHICLE
- PARKED VEHICLE
- FIXED OBJECT
- INJURY ACCIDENT
- FATAL ACCIDENT



ACCIDENT STATISTICS
PIEDMONT - KOUNTZ

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR		3	1		2	6
ACCIDENT TYPE	OFF RD. 5	ANG	HED ON	SOE SWP	RER END	OTHER 1
WEATHER	C 5	CL 1	R	S	F	
ROAD CONDITION	O 5	W 1	I	S		
LIGHT CONDITION	DAY 1		NITE 5			
SEVERITY	POO 3		INJ 3			FATA
ALCOHOL INVOLVED		YES 5		NO 1		



SCALE: 1" = 200'

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-3033	EXISTING CONDITIONS	PIEDMONT RD - KOUNTZ RD	FIGURE NO.

PIEDMONT - KOUNTZ ROAD — COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	4	Ea	$100.00	$400.00
2	NEW SIGNS (6.1 TO 10 SF)	5	Ea	$140.00	$700.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	6	Ea	$50.00	$300.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	4	Ea	$20.00	$80.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$6.00	$0.00
9	DELINEATORS, FLEXIBLE	0	Ea	$20.00	$0.00
10	TRIM TREES	0	LS	$0.00	$0.00
11	APPROACH WORK	1	LS	$2,800.00	$2,800.00

TOTAL CONSTRUCTION COSTS = $4,280.00

PIEDMONT - KOUNTZ RDS — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD F/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. F/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	3	2	60%	1.8	1.2
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	1	15%	0.0	0.2
TOTALS :	3	3	***	1.8	1.4

% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 45.0%

SCALE: 1" = 200'

REMOVE

NEW 36"X36" R1-1 & ST. NAME SIGNS

SPEED LIMIT 35

PIEDMONT

KOUNTZ

NEW 36"X36" W2-1 W/ SUPLEMENTARY ST. NAME SIGN (BLACK ON YELLOW)

REBUILD ROAD APPROACH TO ALIGN WITH PIEDMONT

RELOCATE POWER POLE & MAIL BOXES

10'

10'

COUNTY TO REQUIRE LAND OWNER TO MOVE FENCE BACK 10' ALONG EACH ROADWAY OR INSTALL CHAIN LINK FENCE IN THE CLEAR VISION ZONE.

FLATTEN DITCH SECTION TO ELIMINATE ABRUPT EDGE

REGULAR MAINTENANCE IS REQUIRED TO REDUCE WASHBOARD ROAD EFFECTS

NEW 36"X36" W3-1A

NEW 36"X36" R1-1 & ST. NAME SIGNS

REMOVE

REMOVE

REMOVE

2 NEW OM-3R & 2 NEW OM-3L 12"X36"

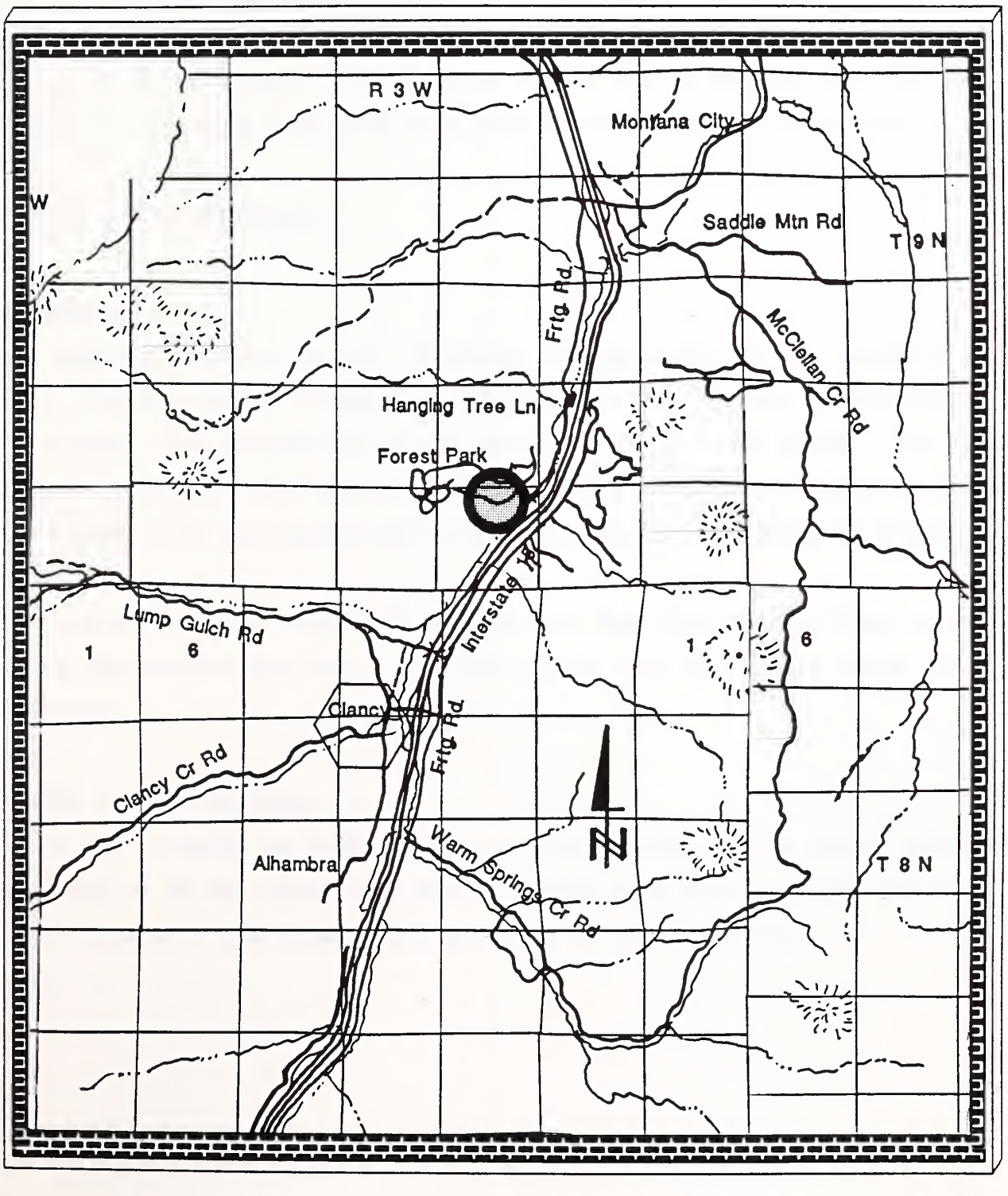
NEW 36"X36" W2-1 W/ SUPLEMENTARY ST. NAME SIGN (BLACK ON YELLOW)

PIEDMONT RD

KOUNTZ RD

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 406-[illegible]	SHORT TERM IMPROVEMENTS	PIEDMONT RD - KOUNTZ RD	FIGURE NO.

FOREST PARK ROAD
PRIORITY # 6



FOREST PARK DRIVE

PRIORITY NUMBER 6

SITE DESCRIPTION

Forest Park Drive is a rural mountain road which provides access to residences and summer homes South of Helena, Montana. It begins at an intersection with Hanging Tree Lane west of Interstate 15 and approximately one mile south of an intersection with I-15 Frontage Road. It proceeds in a westerly direction for a distance of 0.5 miles and than has a circuitous route through a large rural subdivision. The accident cluster site is located from the intersection with Hanging Tree Lane to a point approximately 0.5 miles west.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. The first half of Forest Park Drive is fairly flat, but has several horizontal curves. The second half of the section is on a steep grade. The road surface is 24 foot wide gravel with an extreme washboard surface. There are several drive approaches and a large mailbox turn out along its length.

The intersection with Hanging Tree Lane and Blue Sky Heights Road is completely uncontrolled and has a mail box cluster turn out located within the intersection.

Traffic Control Devices

There are currently no traffic control devices existing at the study, with the exception of 25 mph speed limit signs. These signs were probably installed at the request of the homeowners and have no basis in reality.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Forest Park Drive is 680. Traffic volumes throughout the five year accident period have probably remained relatively stable, with slight increases over the period. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT. The existing condition sketch illustrate the peak hour turning movement volumes at the intersection site.

Traffic Operations

First impressions of the site would indicate that the intersection area is the most dangerous portion of the entire area. Vehicles enter the area from Hanging Tree Lane at relative high speeds from a sharp 90 degree turn and are immediately in the intersection. It is pure luck that even the most familiar drivers have not had accidents at this location.

The remainder of the roadway has an alignment and roadside environment which could accommodate speeds way in excess of 25 mph and from observations, vehicles do travel in excess of the limit.

Some sight distance restriction caused by trees was noted at a few drive approaches. Other than that the most notable problem was maintaining vehicle control on the washboard surface.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 6 accidents reported at this site during the 5 year period. There was a mixture of accident types. Three involved single vehicle loss of control and the other three consisted of angle, sideswipe and head on accidents. Three of the accidents occurred on snowy road surfaces. Two of the accidents produced injuries. All of the accidents occurred in daylight conditions.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made to reduce the effects of the operational problems noted above. Delineation of the roadway shoulders will help define the proper vehicle path thru the winding curve area. Trees which block sight distance at drive approaches should be trimmed or cut down. Most importantly, regular maintenance is required to reduce the effects of the washboard road. If the degree of maintenance required is too costly for the County, the road surface should be upgraded to asphalt treatment or a special improvement district should consider paving sections of these roads.

A speed zone study is highly recommended. Posting a speed zone too low, not only makes most drivers law breakers, but it also makes it impossible to post advisory speed warning signs for extreme conditions.

The minor leg of the intersection should be signed to yield and curve warning and intersection warning signs be installed along Hanging Tree Lane to prevent an inevitable accident from occurring on the east end of the site.

Costs associated with the above noted improvements are estimated to be $1,650.00. This is a medium cost project, but a large portion of the funds are eligible for MDOH funding.

Long term improvements at this site would include reconstruction of curves and road surface paving along with reconstruction of the intersection area. A speed limit study should be completed as soon as possible. If a significant increase is warranted, then additional signing could be warranted for curves etc.

BENEFITS

Accident reduction at this site could only be as high as 40 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 6,371.00. Thus, the computed benefit/cost ratio would be 13.13, second highest of all study sites.

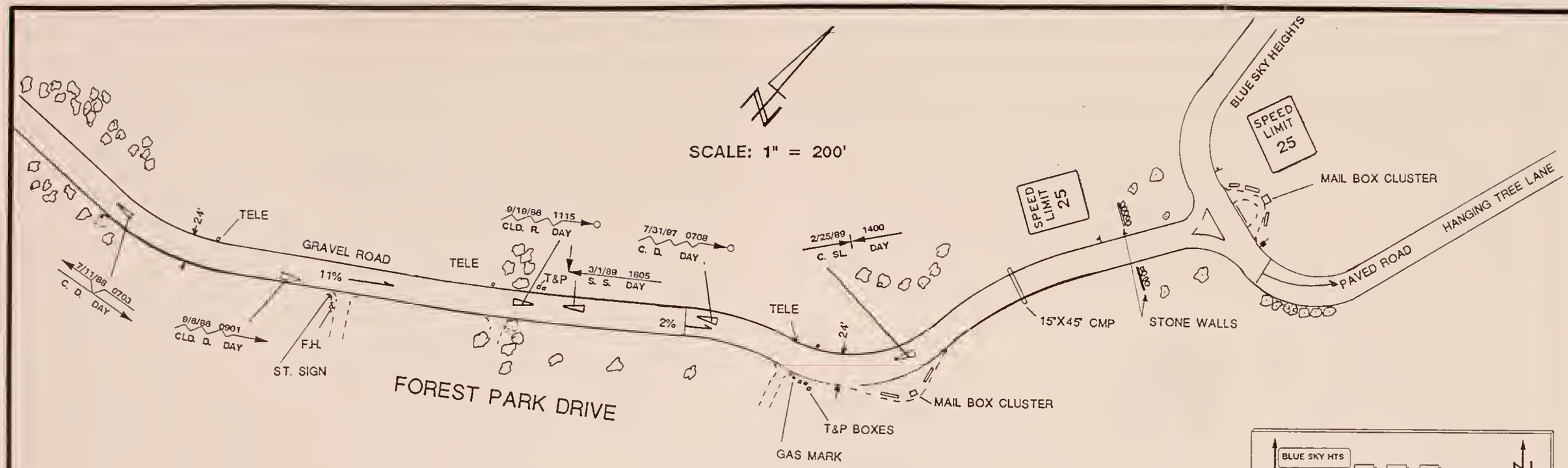
FOREST PARK DRIVE EAST BOUND AT WEST END

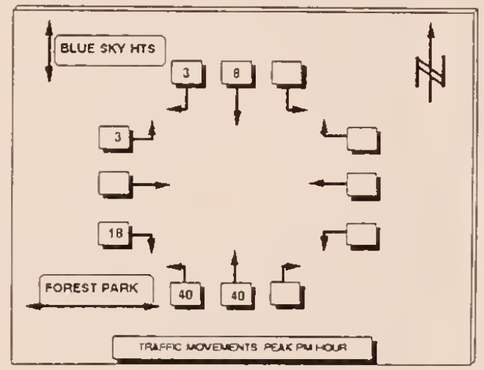
FOREST PARK DRIVE EAST BOUND MID SECTION
(NOTE WASHBOARD)

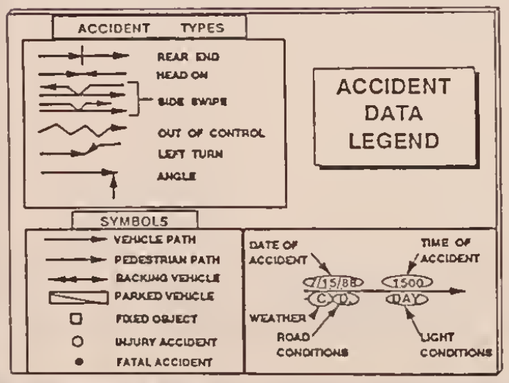
FOREST PARK DRIVE WEST BOUND AT EAST END

FOREST PARK DRIVE WEST BOUND MID SECTION

SCALE: 1" = 200'



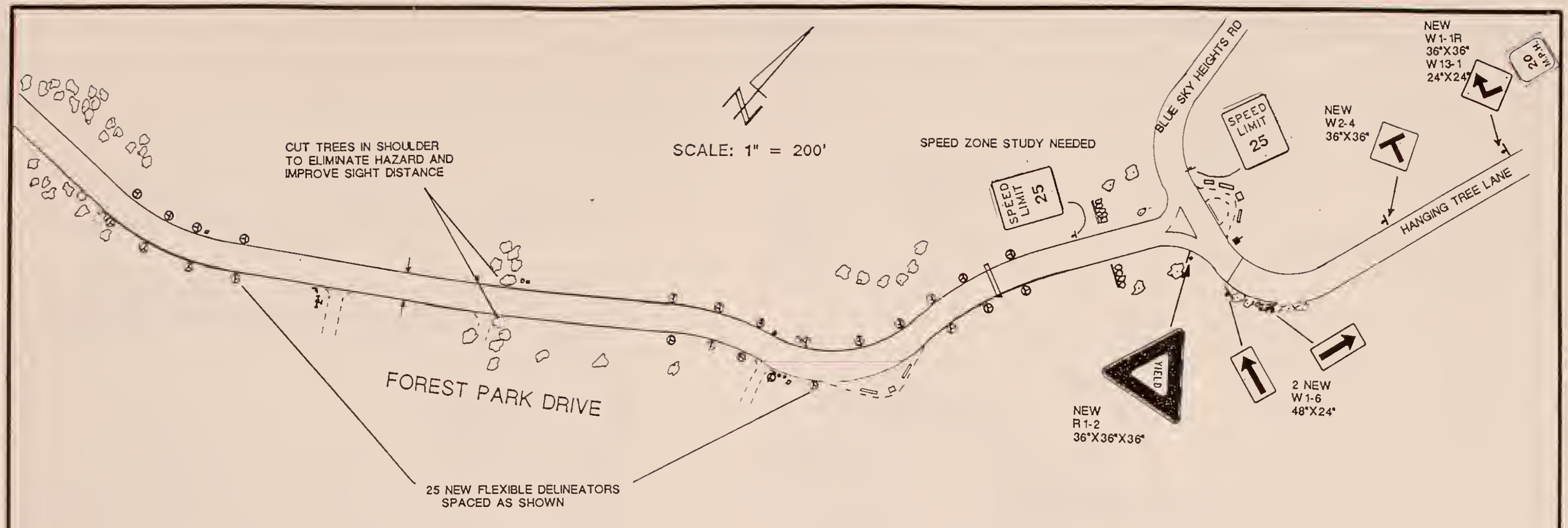




ACCIDENT STATISTICS
FOREST PARK DRIVE

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR		2	1	1	2	6
ACCIDENT TYPE	OFF RO.	ANG	HED ON	SOE SWP	NER ENO	OTHER
	3	1	1	1		
WEATHER	C	CL	R	S	F	
	3	2		1		
ROAD CONDITION	O	W	I	S		
	3			3		
LIGHT CONDITION	DAY		NITE			
	6		0			
SEVERITY	PDO		INJ		FATA	
	4		2			
ALCOHOL INVOLVED		YES		NO		
		0		6		

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5093	EXISTING CONDITIONS	FOREST PARK DRIVE	FIGURE NO.



WASHBOARD ROAD REQUIRES
CONTINUOUS MAINTENANCE OR
A MORE DURABLE SURFACE TREATMENT

FOREST PARK ORIVE — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	1	5%	0.0	0.1
ANGLE	0	1	20%	0.0	0.2
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	1	20%	0.0	0.2
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	1	2	40%	0.4	0.8
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	1	5	***	0.4	1.3

% REDUCTION IN INJURY/FATAL ACCIDENTS =	40.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS =	25.0%

FOREST PARK DRIVE — COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	5	Ea	$140.00	$700.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	1	Ea	$50.00	$50.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	0	Ea	$20.00	$0.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$8.00	$0.00
8	DELINEATORS, FLEXIBLE	25	Ea	$20.00	$500.00
10	TRIM TREES	1	LS	$400.00	$400.00
11	APPROACH WORK	0	LS	$0.00	$0.00

TOTAL CONSTRUCTION COSTS =	$1,650.00

DATE:

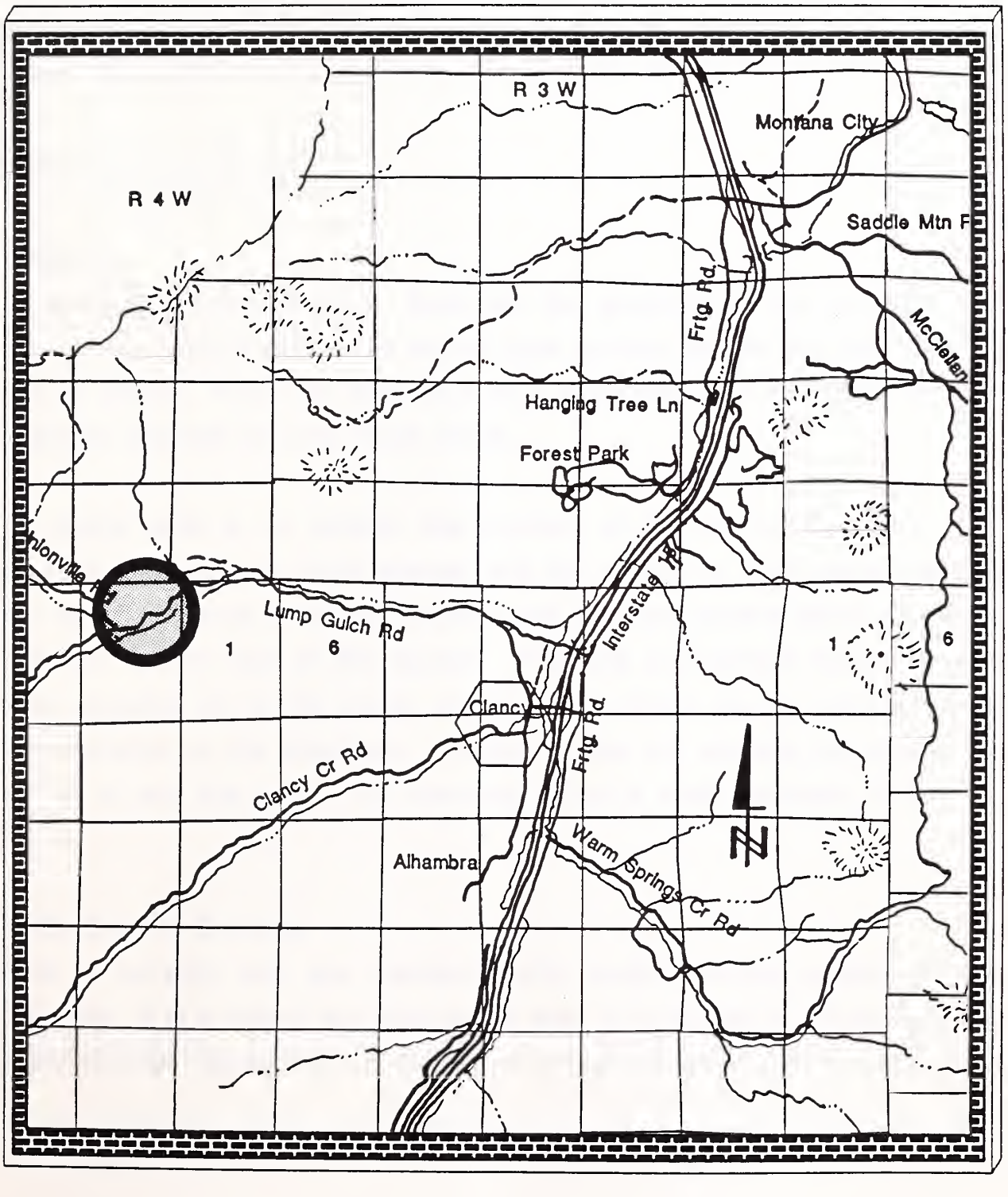
MARVIN & ASSOCIATES
Traffic, Transportation & Civil Engineers
1127 Alderson Ave
Suite 204
Billings, MT 59102
(406) 248-5083

SHORT TERM IMPROVEMENTS

FOREST PARK DRIVE

FIGURE NO.

LUMP GULCH ROAD, 4 MILE
PRIORITY # 7



LUMP GULCH ROAD, 4 MILE

PRIORITY NUMBER 7

SITE DESCRIPTION

Lump Gulch Road is a rural mountain road which provides access to residences, farms and cabins South of Helena and west of Clancy, Montana. It begins at an intersection near Clancy just west of Interstate 15 and proceeds in a westerly direction for a distance of approximately 12 miles and ends at Park Lake. It intersects Unionville Road approximately 4.5 miles west of Clancy and that point is the western end of the .6 mile cluster

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. Lump Gulch Road has an asphalt type surface for the first two miles west of Clancy. From that point on, it is a gravel/dirt road that winds through mountains adjacent to Lump Gulch Creek.

The cluster area is not entirely characteristic of the rest of the road. The curves in this area are much sharper and the surface is much more irregular. This section of road is heavily forested and their are several drive approaches in the eastern half of the section. Roadside environment includes steep banks dropping off to the creek; dirt and rock slopes on the mountain side; and vegetation on the shoulders. Vertical grades are variable, but mostly under 4% at any one point. The roadway varies in width between 16 and 18 feet.

Traffic Control Devices

There is currently only one standard traffic control devices existing at the study site. It is a school bus stop ahead sign. It is located in advance of the Unionville Road intersection. A direction informational sign is located right at

the intersection in a location that helps block the already limited view of the intersection.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Lump Gulch Creek Road is 400. Traffic volumes throughout the five year accident period have probably remained relatively stable. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT.

Traffic Operations

First impressions of this site indicate that this section of road is different from the remainder of Lump Gulch Creek Road. Numerous curves in the winding road are encountered, but these curves are significantly sharper with more roadside obstacles than at any other location.

the location of the intersection provides a complete surprise to anyone entering it. It was noted that drivers enter the intersection from the blind corner westbound at a high rate of speed and would have no chance to stop if someone were infringing on the other lane or walking along the road.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 10 accidents reported at this site during the 5 year period, one of two highest sites in this study. Six of the accidents were single vehicle accidents occurring along the length of the site. Head on and sideswipe accidents accounted equally for the remaining accidents. Only three of the accidents occurred on dry road surfaces. Only two of the accidents produced injuries. The accident rate at night was much greater than the daytime accident rate.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made in an effort to reduce the effects of the operational problems noted above. Advanced warning of the curved section of road which is different than the remainder of Lump Gulch Road should provide sufficient information that drivers will be a degree more alert. The 25 mph advisory will help provide information as to the degree of curvature and operating conditions in this section.

The Unionville Road intersection and approaches to it, should be reconstructed to allow for improved sight distance and more avoidance maneuver room. An area of the roadway should be graded to allow the school bus to safely pick up and let out children. The informational sign should be located to provide good visibility without blocking the road line of sight.

Advanced intersection warning signs are required to improve the chances of safely turning or going thru the intersection area without incidence. Trees and other vegetation along this section should be trimmed to provide adequate sight distance.

Costs associated with above noted improvements are estimated to be $6,120.00. Most of this cost would be involved in reconstruction in the intersection area.

Long term improvements at this site cannot be foreseen at this time. Once the physical changes required by short term improvements are made, any further improvements would be in excess of the roads service character.

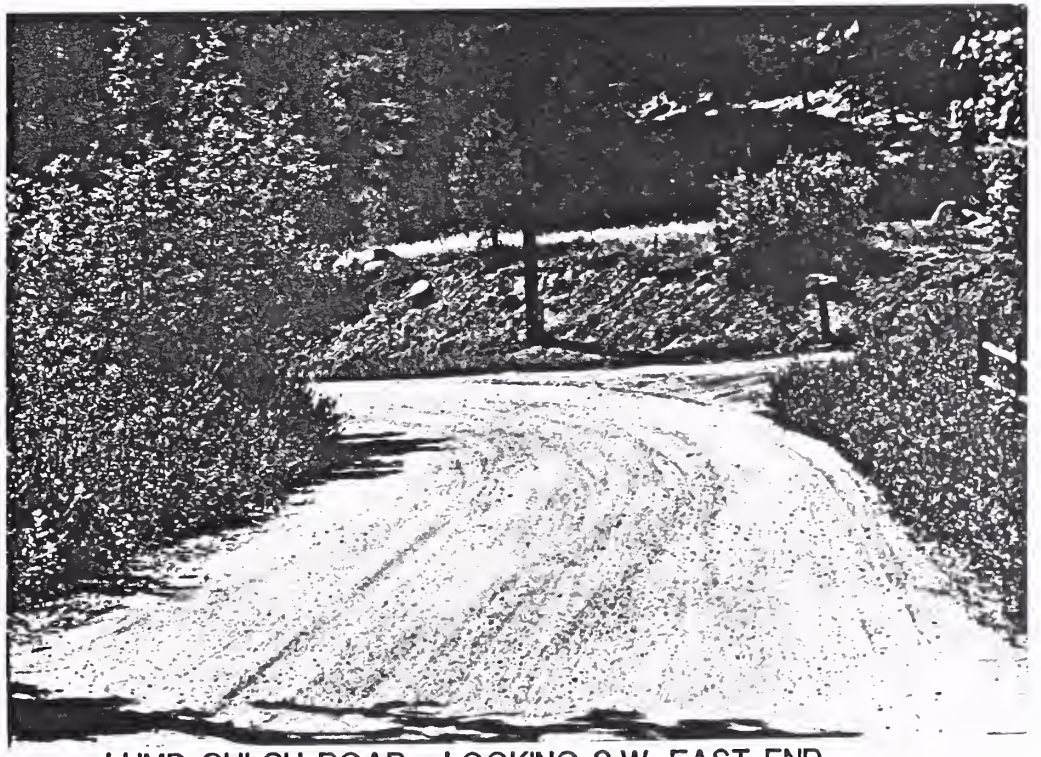
BENEFITS

Accident reduction at this site could be as high as 50 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 8,414.00. The computed benefit/cost ratio would be 4.91, a very good rate of return for a modest investment.

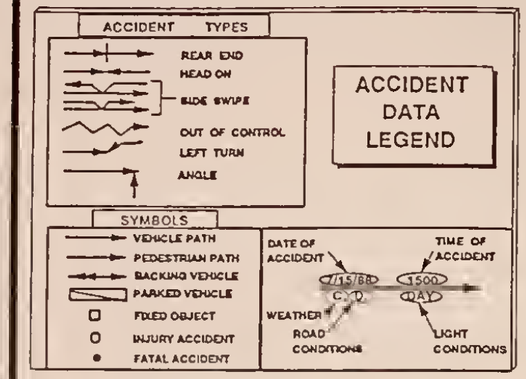
LUMP GULCH ROAD - LOOKING N.E. WEST END

LUMP GULCH ROAD - LOOKING S.W. MIDDLE SECTION

LUMP GULCH ROAD - LOOKING S.W. WEST END



LUMP GULCH ROAD - LOOKING S.W. EAST END



SCALE: 1" = 200'

ACCIDENT STATISTICS
LUMP GULCH RD, 4 MILE

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR	1	1	4	2	2	10
	OFF RD.	ANG	HED ON	SDE SWP	REAR END	OTHER
ACCIDENT TYPE	6		2	2		
	C	CL	R	S	F	
WEATHER	7	1	1	1		
	O	W	I	S		
ROAD CONDITION	3	1	4	2		
	DAY		NITE			
LIGHT CONDITION	5		5			
	PDO		INJ		FATA	
SEVERITY	8		2			
		YES		NO		
ALCOHOL INVOLVED		1		9		

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	EXISTING CONDITIONS	LUMP GULCH RD - 4 MILE	FIGURE NO.

LUMP GULCH ROAD — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	2	15%	0.0	0.3
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	2	20%	0.0	0.4
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	2	4	50%	1.0	2.0
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	2	8	***	1.0	2.7

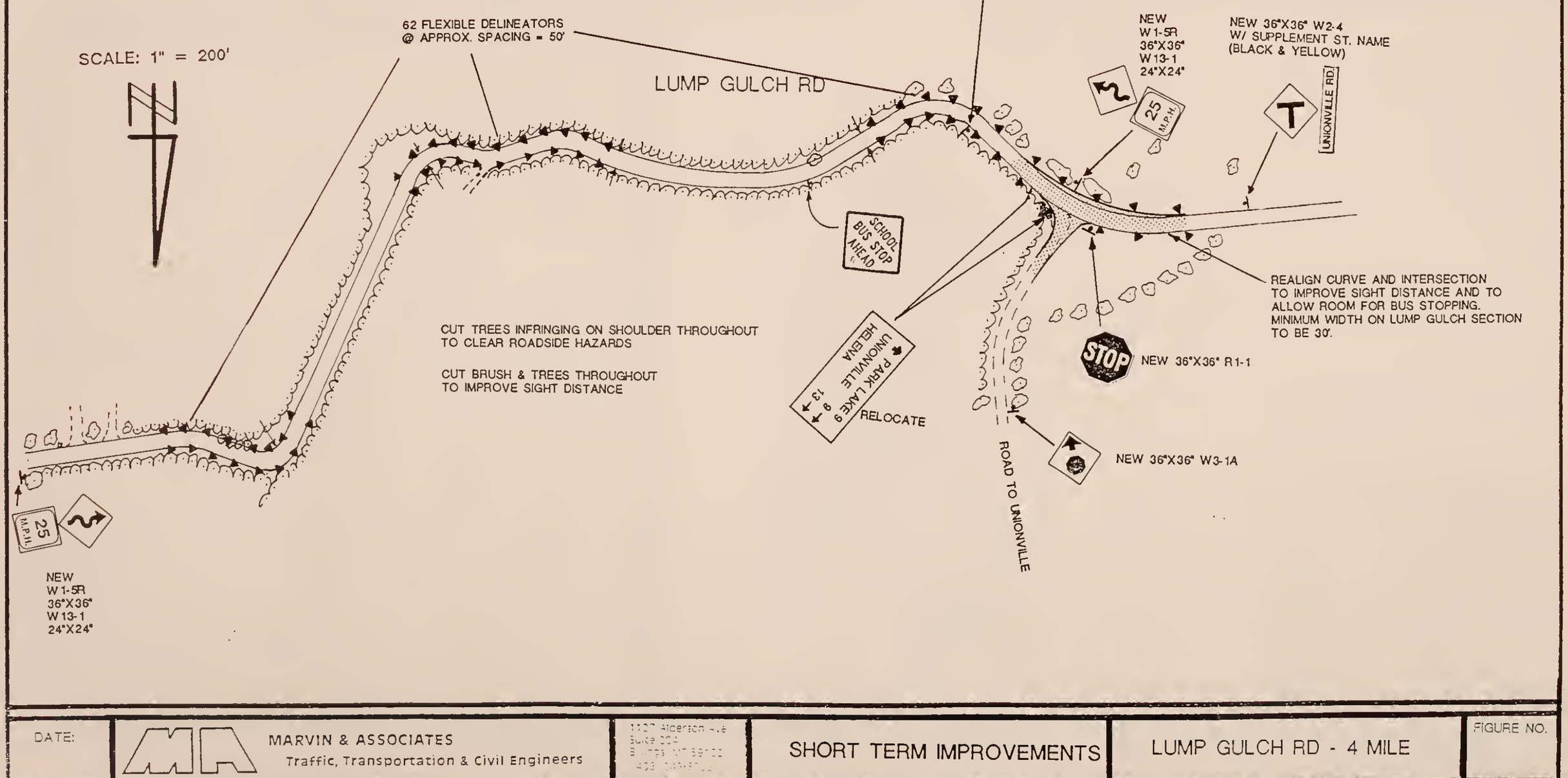
% REDUCTION IN INJURY/FATAL ACCIDENTS = 50.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 33.8%

LUMP GULCH ROAD — COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTIT	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	6	Ea	$140.00	$840.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	4	Ea	$50.00	$200.00
5	RELOCATE SIGNS	1	Ea	$40.00	$40.00
6	REMOVE SIGNS	0	Ea	$20.00	$0.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$6.00	$0.00
9	DELINEATORS, FLEXIBLE	62	Ea	$20.00	$1,240.00
10	TRIM TREES	1	LS	$800.00	$800.00
11	APPROACH WORK	1	LS	$3,000.00	$3,000.00

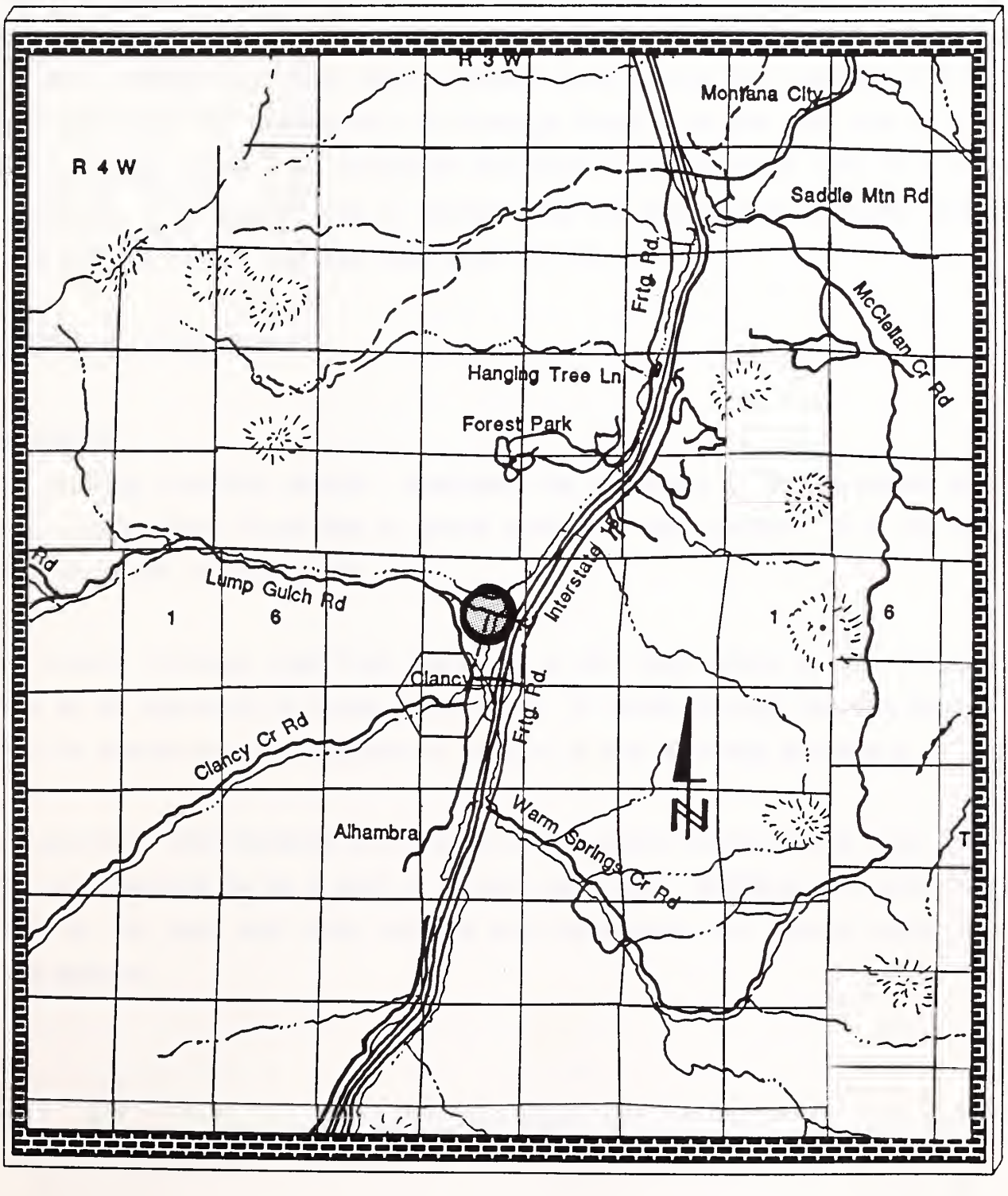
TOTAL CONSTRUCTION COSTS = $6,120.00

SCALE: 1" = 200'



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1107 Alderson Ave Suite 204 Billings MT 59102 406-248-0161	SHORT TERM IMPROVEMENTS	LUMP GULCH RD - 4 MILE	FIGURE NO.

LUMP GULCH, CLANCY FRONTAGE
PRIORITY # 8



LUMP GULCH - CLANCY FRONTAGE

PRIORITY NUMBER 8

SITE DESCRIPTION

Lump Gulch Road is a rural mountain road which provides access to residences, farms and cabins South of Helena and west of Clancy, Montana. It begins at an intersection near Clancy just west of Interstate 15 and proceeds in a westerly direction for a distance of approximately 12 miles and ends at Park Lake. An extension of Lump Gulch Road due east toward I-15 on the east end intersect a county road extension from Clancy that parallels I-15 on the west side. The designated I-15 Frontage Road is on the east side of I-15 and the Lump Gulch Road extension intersects it on the other side of a I-15 underpass. The cluster area is located near the intersection of Lump Gulch Road and the county frontage road west of I-15.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. Lump Gulch Road has a gravel surface in this section. It is 20 feet wide on a 2% vertical grade.

The county frontage road from Clancy is a dirt road which is only 14 feet wide at its approach to Lump Gulch Road. It winds through several houses near the intersection and appears to be part of the residents driveways.

The geometry and roadside environment of the entire intersection is very complex and appears to be a part of a barn yard road. Buildings are extremely close to the road and farm vehicles and implements are parked within the road surface.

Traffic Control Devices

There are currently only two traffic control devices existing at the study site. One is a very old and outdated slow children at play sign and the other is a non standard yield sign, located at least a hundred feet in advance of the intersection on the northbound county road approach.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Lump Gulch Creek Road is 200. Traffic volumes throughout the five year accident period have probably remained relatively stable. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT.

Traffic Operations

First impressions of this site would lead one to believe that he was on the wrong road and was entering someone's farm yard. In the area of the intersection, the surrounding buildings and parked implements makes it difficult to determine the alignment of the road or if there even is a road. The remainder of the road has the appearance of most county roads and approach speeds are higher than what would be comfortable through the intersection area. The intersection area totally lacks any type of traffic control and drivers unfamiliar with the situation would have trouble reacting to unexpected conflicts. Farm implements move around in this area frequently (see photos) and temporarily block the roadway.

The county road approach from the south winds through peoples yards prior to the intersection opening. At the top of the hill on the approach to the intersection, an old style yield sign is erected 100' in advance of the intersection. This causes great confusion and diverts the drivers attention away from the critical task of driving through the intersection.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 3 accidents reported at this site during the 5 year period. All of the accidents involved single vehicles. One accident

occurred on each of the three approaches to the intersection. Two of the accidents occurred on snowy roads and at night. One of the accidents produced injuries.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made in an effort to standardize signing and to warn drivers of the conditions to be encountered. An effort is also suggested to reduce some of the effects of the operational problems noted above. There are no warning signs which would apply to the conditions encountered in the intersection, however advanced intersection warning with a supplementary advisory speed plate may convey several messages: 1. The signs will inform motorists that they are on a county road. 2. An intersection is forthcoming. 3. Conditions at the intersection are such that slower speeds are required.

The yield sign, even if installed at the proper location, is an inappropriate application at this intersection. A stop sign properly located is necessary because of sight distance restrictions and unusual traffic conditions. An advanced warning sign is necessary because of sight distance obstacles.

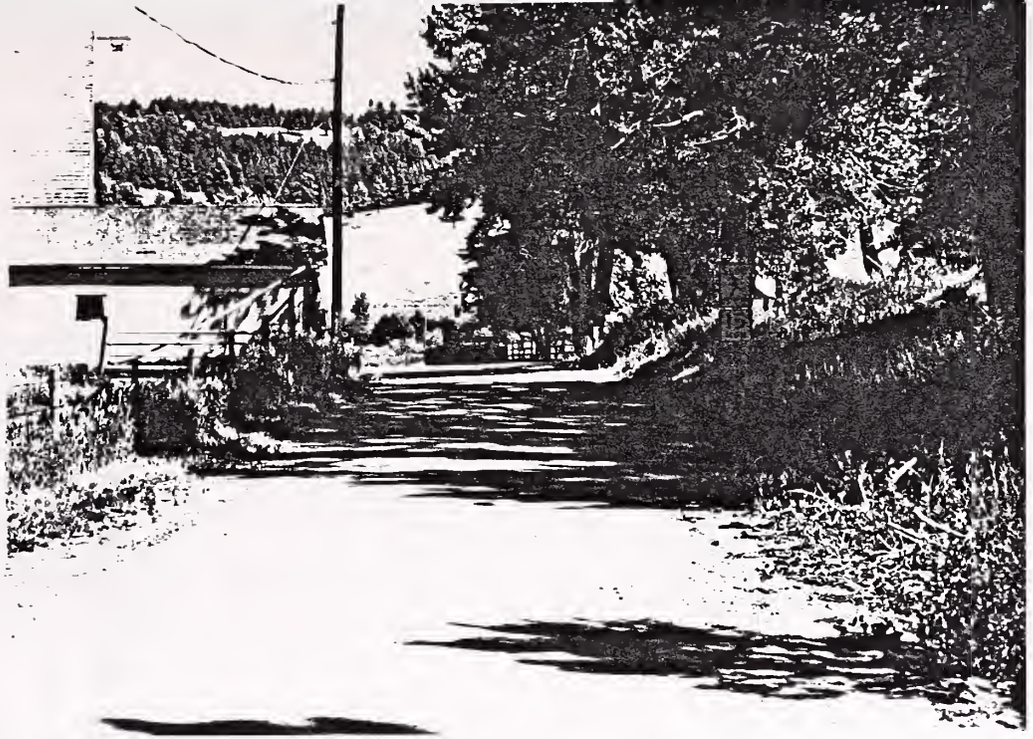
It is also suggested that the south road approach be realigned to eliminate a sharp jog just prior to the intersection. The existing approach alignment disguises the location of the intersecting roadway.

Costs associated with above noted improvements are estimated to be $1,500.00.

Long term improvements at this site should consider relocation of the south approach to a point east or west of the buildings and away from the intense roadside development.

BENEFITS

Accident reduction at this site due to the suggested improvements could only be as high as 20 %. Even then, annual economic savings, in terms of accident reduction could reach $ 1,639.00. The computed benefit/cost ratio would be 3.68, a very good rate of return for a modest investment.

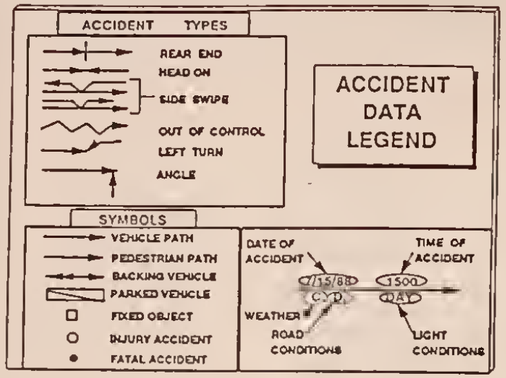


LUMP GULCH, CLANCY FRTG. - LOOKING EAST

LUMP GULCH, CLANCY FRTG. - LOOKING NORTH FROM CNTY RD

LUMP GULCH, CLANCY FRTG. - LOOKING WEST

LUMP GULCH, CLANCY FTRG. - LOOKING SOUTH AT COUNTY RD



ACCIDENT STATISTICS
LUMP GULCH, CLANCY FR

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR			2		1	3
ACCIDENT TYPE	OFF RD. 3	ANO	HEO ON	SDE SWP	REA ENO	OTHER
WEATHER	C 1	CL 2	R	S	F	
ROAD CONDITION	O 1	W	I	S 2		
LIGHT CONDITION	DAY 1		NITE 2			
SEVERITY	POD 2		INJ 1			FATA
ALCOHOL INVOLVED		YES 1		NO 2		

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5083	EXISTING CONDITIONS	LUMP GULCH, CLANCY FRTG	FIGURE NO.

LUMP GULCH - CLANCY ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	1	2	20%	0.2	0.4
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	0	0%	0.0	0.0
TOTALS :	1	2	***	0.2	0.4

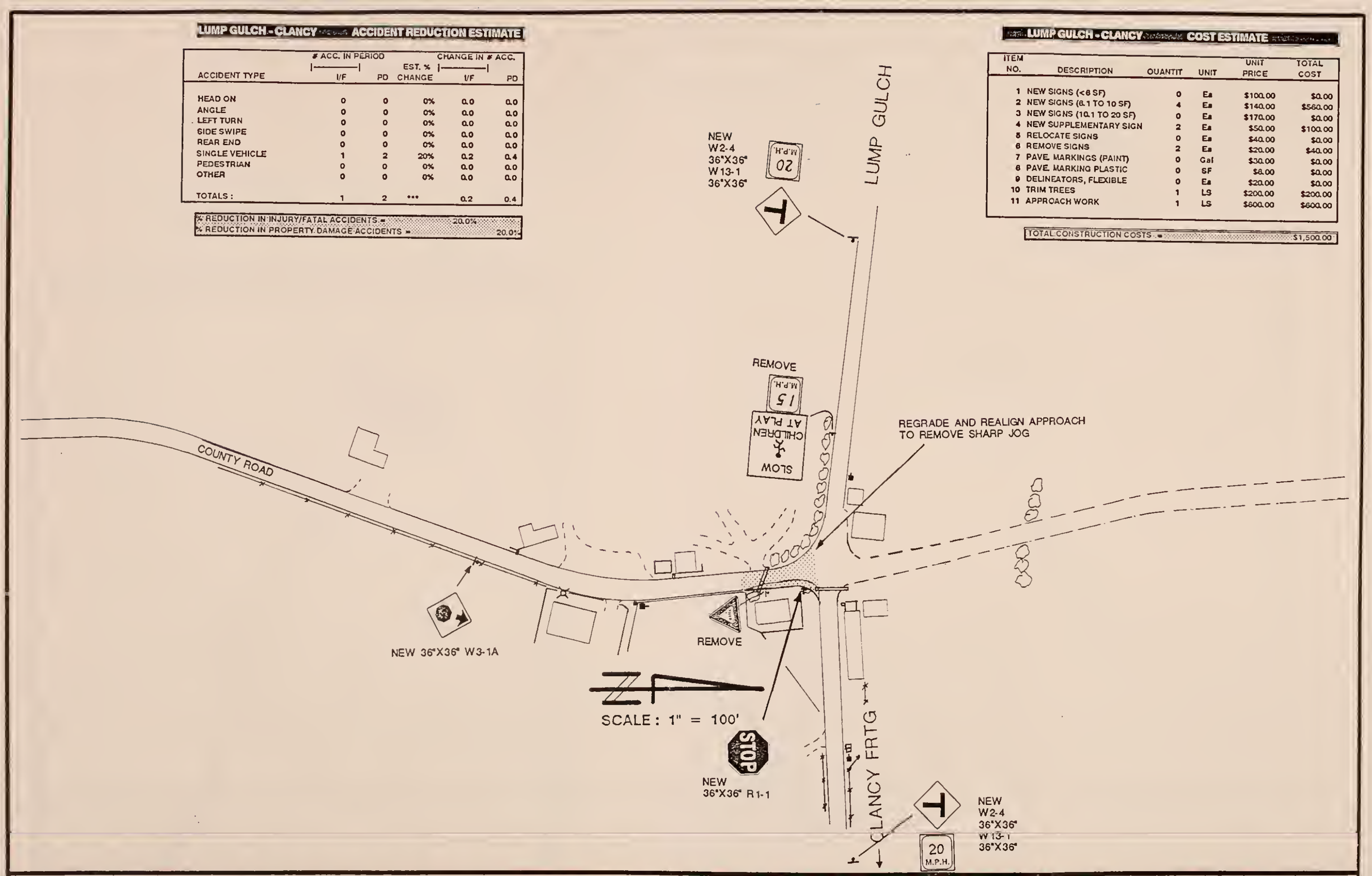
% REDUCTION IN INJURY/FATAL ACCIDENTS = 20.0%

% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 20.0%

LUMP GULCH - CLANCY COST ESTIMATE

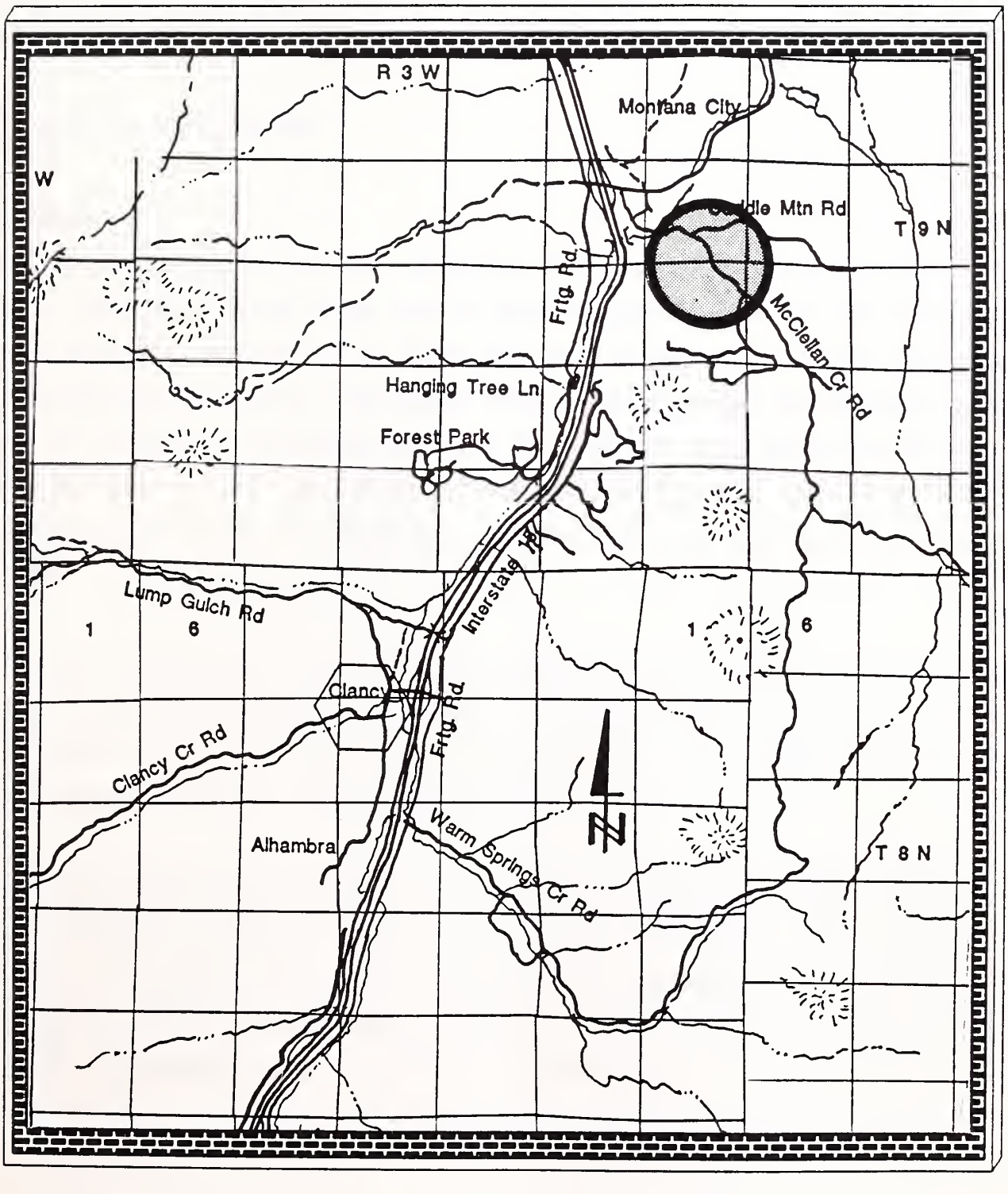
ITEM NO.	DESCRIPTION	QUANTIT	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	0	Ea	$100.00	$0.00
2	NEW SIGNS (6.1 TO 10 SF)	4	Ea	$140.00	$560.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	2	Ea	$50.00	$100.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	2	Ea	$20.00	$40.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$8.00	$0.00
9	DELINEATORS, FLEXIBLE	0	Ea	$20.00	$0.00
10	TRIM TREES	1	LS	$200.00	$200.00
11	APPROACH WORK	1	LS	$600.00	$600.00

TOTAL CONSTRUCTION COSTS = $1,500.00



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	SHORT TERM IMPROVEMENTS	LUMP GULCH, CLANCY FRTG	FIGURE NO.

McCLELLAN ROAD
PRIORITY # 9



McCLELLAN CREEK ROAD

PRIORITY NUMBER 9

SITE DESCRIPTION

McClellan Creek Road is a rural mountain road which provides access to residential subdivisions, farms and cabins South of Helena and west of Interstate 15. It begins at an intersection with Secondary Route 518 near Montana City just west of Interstate 15 and proceeds in a south easterly direction for a distance of approximately 4 miles and splits into several other mountain roads.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. McClellan Creek Road has an asphalt type surface for the first two miles south of Secondary 518. From that point on, it is a gravel/dirt road that winds through mountains. The cluster area is entirely within the asphaltic section of roadway. Roadway width on the southern most portion is 20 feet. The remainder of the road varies between 20 and 23 feet. The thin surfacing material on the road is broken up and potholes have developed along its length.

Horizontal alignment of this site is characterized by short, sharp curves, tangent sections and broken back curves. Longer curves in this section are compound curves with multiple radii within single curves. Grade on the roadway varies between 7 and 9 % throughout.

There are only six approaches to the road along the section length. The major approach is Saddle Mountain Road (signed as Sawmill Road). This approach is a partially blind approach due to grade, curvature and a high roadside berm. Other roadside features include fences, steep back slopes and fill slopes. This section of road is not in a forested area.

Traffic Control Devices

There is currently only one standard traffic control devices existing at the study site. It is a 35 mph speed limit sign. One other sign, "Sawmill Road" street name sign is painted on wood.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on McClellan Creek Creek Road is 900. Traffic volumes throughout the five year accident period have probably remained relatively stable. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT. Peak hour turning movement volumes at the Saddle Mountain Road approach are shown on the existing condition sketch.

Traffic Operations

The paved surface and extended tangent sections on this road encourage drivers to go faster than the posted speed limit. All but one of the curves, the first "S" curve at the north end of the site, ballbank faster than the 35 mph speed limit. The inclination to drive faster is natural and apparently common. On two separate visits to the site, a county sheriff car was monitoring vehicle speeds. Maintaining 35 mph on the downgrade is difficult to accomplish and under certain conditions, not advisable.

Because of the compound and broken back curves on this road, it is difficult to maintain a true line within the travel lane. This situation is compounded by potholes which drivers tend to avoid by maneuvering around them.

The intersection at Saddle Mountain Road is difficult to see until the vehicle is within the intersection area. The approach from Saddle Mountain Road to McClellan Road gives no physical clues to the yield or stop condition ahead and sight distance for the entrance movement is not ideal.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 10 accidents reported at this site during

the 5 year period, one of two highest sites in this study. Five of the accidents were single vehicle accidents occurring along the length of the site. Other accidents involved angles, rear end and fixed object accidents. Only four of the accidents occurred on dry road surfaces. Only one of the accidents produced injuries. The accident rate at night was much greater than the daytime accident rate.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made in an effort to reduce the effects of the operational problems noted above. Advanced warning of the second curve at the north end is advisable since it is the only curve that must be driven at the 35 mph speed limit. It may be advisable to perform a speed study at this site. A more realistic speed limit may be 45 mph. If the limit were raised, warning signs could adequately reflect the driving conditions.

Continuous roadside delineation in this are would greatly assist drivers in correctly identify the roadway alignment, significantly reduce night time accidents.

Advanced intersection warning signs for Saddle Mountain Road with supplementary street name plates would provide drivers information with regard to the location of potential conflicts and reduce decision time for drivers wanting to turn. The approach at this location should also be regraded to allow a better condition for the right turn from the south and to remove a berm that inhibits a clear view of the intersection.

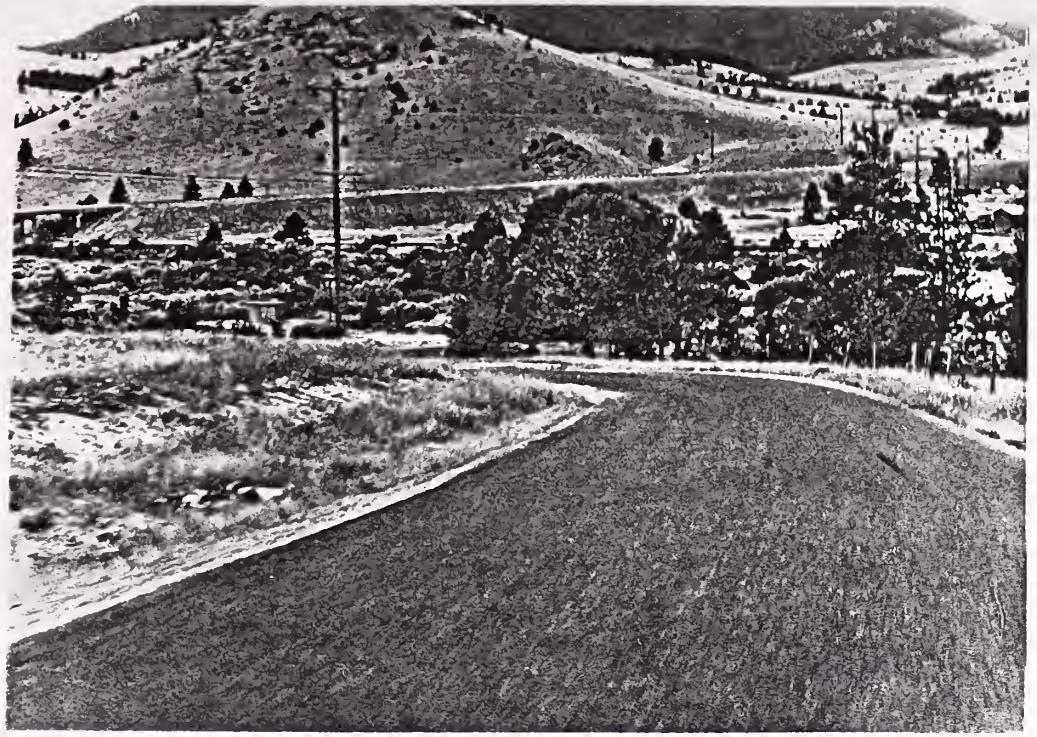
Other improvements suggested are made to mark and identify potential hazards along the roadway.

Costs associated with above noted improvements are estimated to be $4,960.00. More than half of which would be fundable through MDOH Off-system safety funds.

Long term improvements at this site cannot be foreseen at this time. Increased traffic to a level in excess of 1,500 vehicle per day should trigger consideration of a major reconstruction to realign and pave this roadway.

BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could reach $ 5,623.00. The computed benefit/cost ratio would be 3.86, a very good rate of return for the investment.



McCLELLAN CR RD - LOOKING WEST AT WEST END

McCLELLAN CR RD - LOOKING N.W. AT EAST END

McCLELLAN CR RD - LOOKING EAST AT WEST END

McCLELLAN CR RD - LOOKING S.E. AT MID SECTION

ACCIDENT STATISTICS
McCLELLAN ROAD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR	3	3	1	2	1	10

	OFF RD.	ANG	HED ON	SDE SWP	REA END	OTHER
ACCIDENT TYPE	5	1			1	3

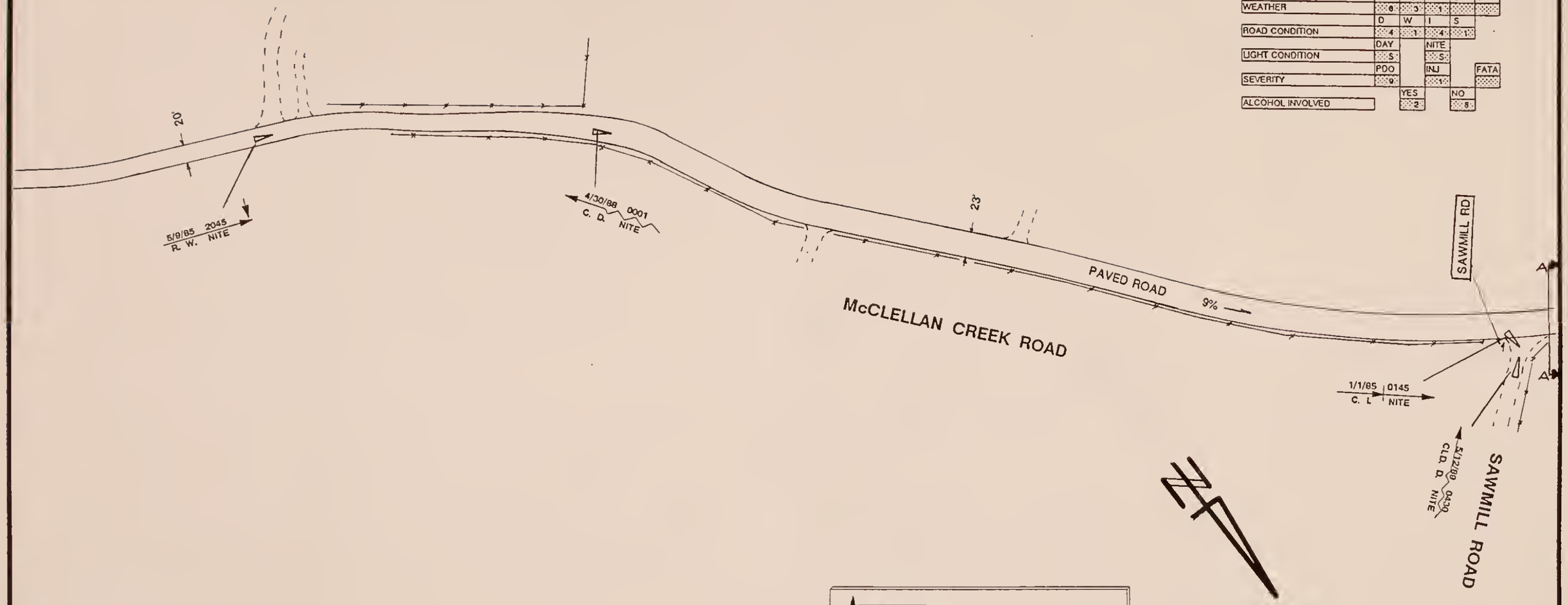
	C	CL	R	S	F
WEATHER	8	3	1		

	D	W	I	S
ROAD CONDITION	4	1	4	1

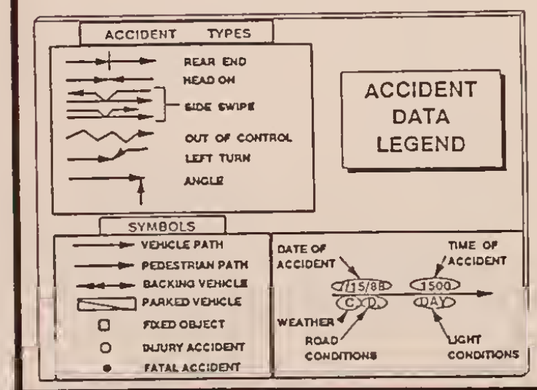
	DAY	NITE
LIGHT CONDITION	5	5

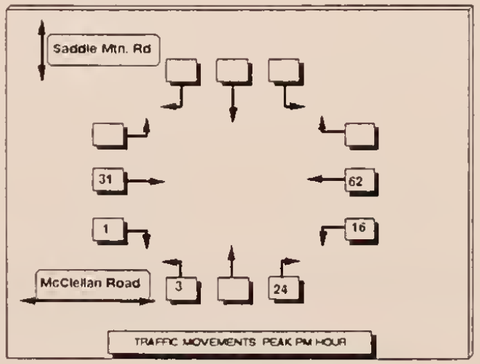
	PDO	INJ	FATA
SEVERITY	9	1	

	YES	NO
ALCOHOL INVOLVED	2	8



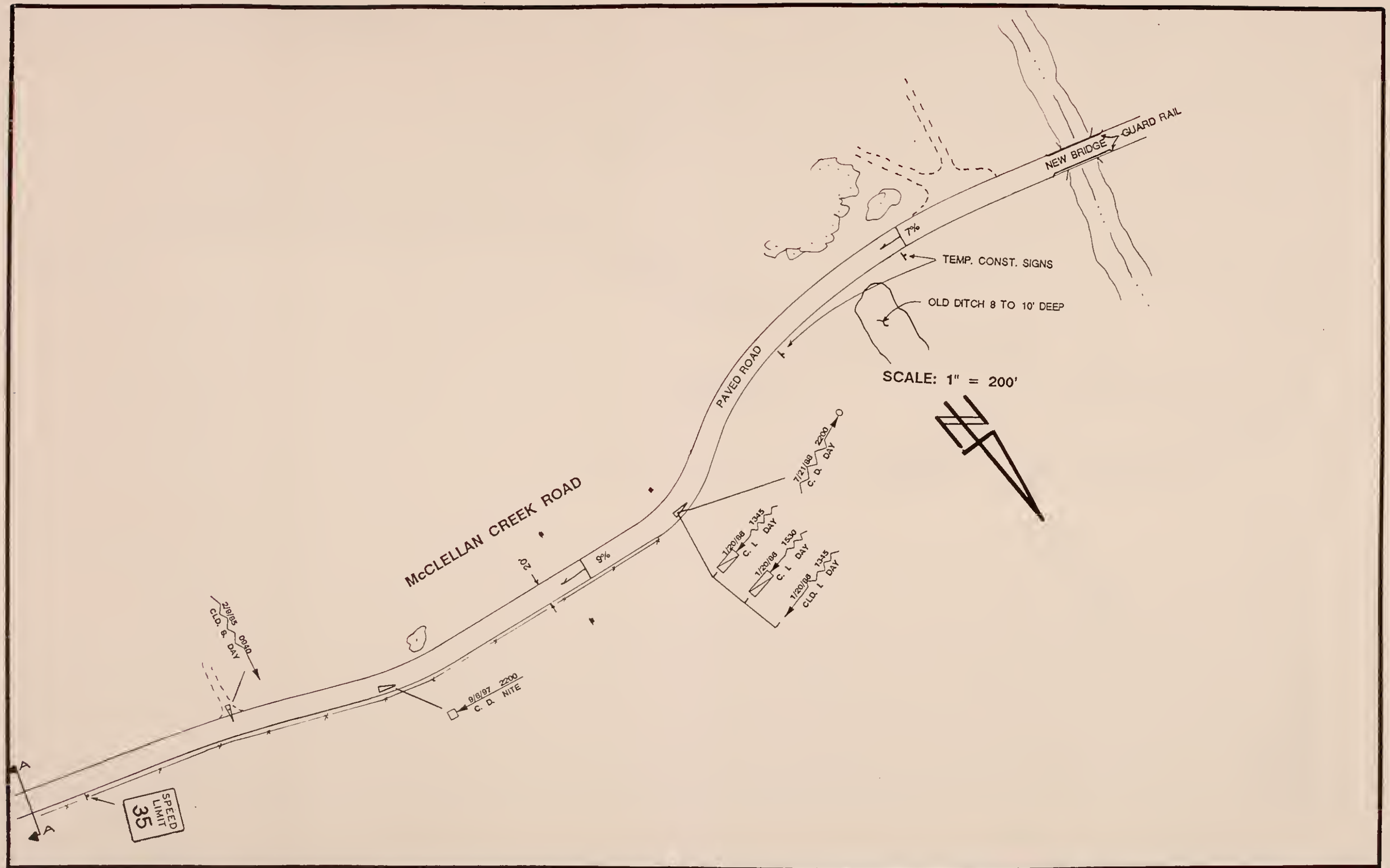
SCALE: 1" = 200'



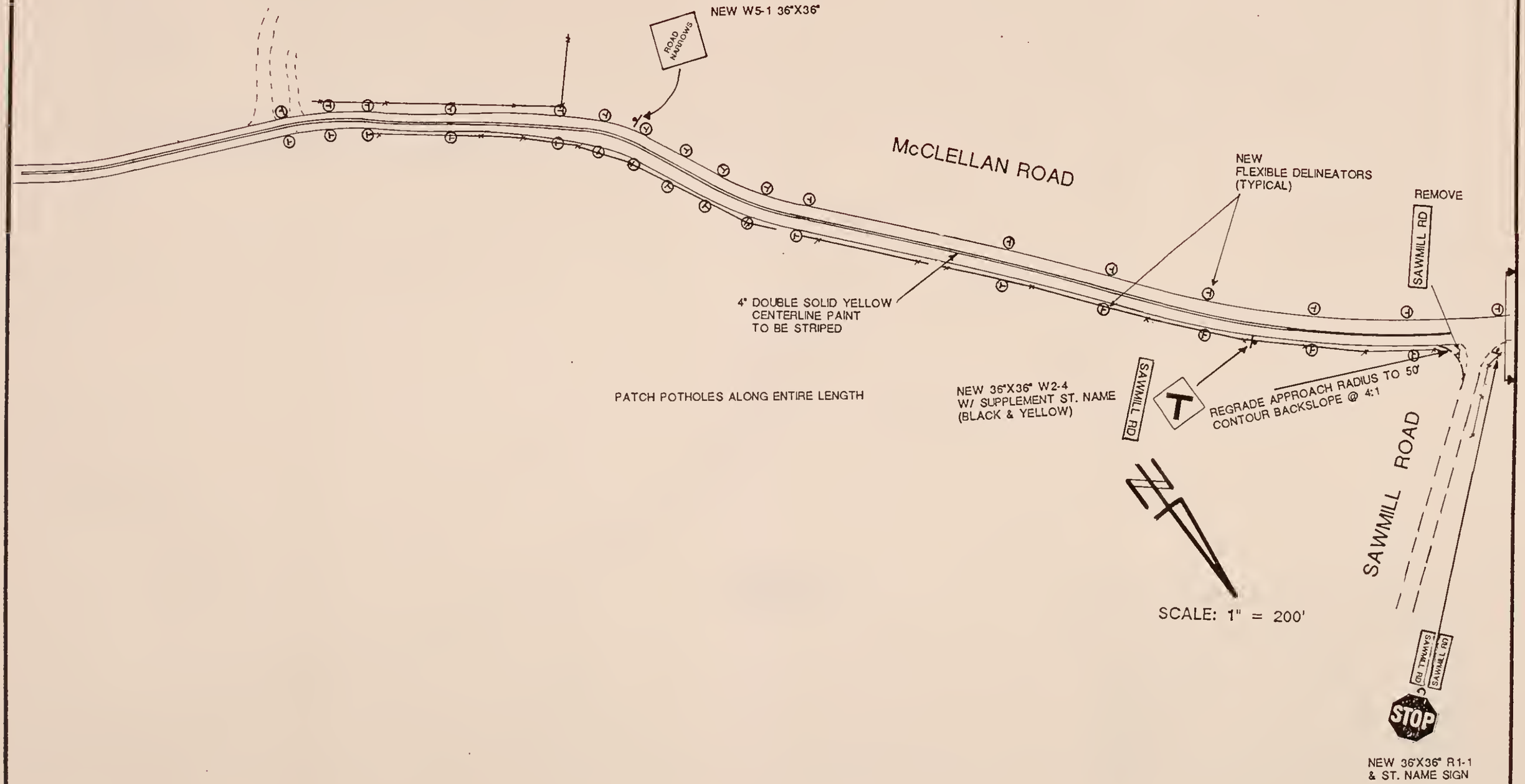


DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5083	EXISTING CONDITIONS	McCLELLAN CREEK ROAD

FIGURE NO.



DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5093	EXISTING CONDITIONS	McCLELLAN CREEK ROAD	FIGURE NO.



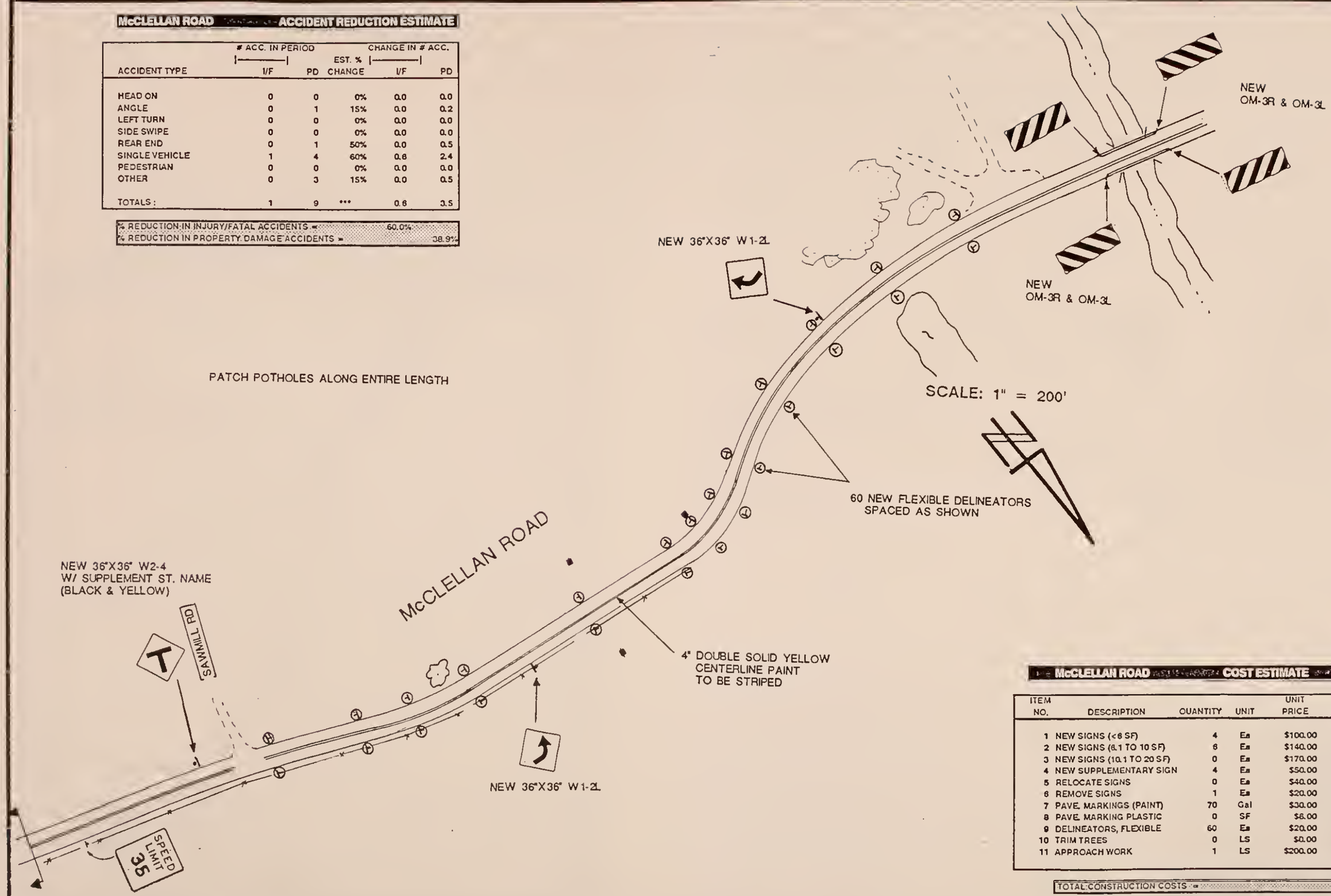
DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5083	SHORT TERM IMPROVEMENTS	McCLELLAN CREEK ROAD	FIGURE NO.

McCLELLAN ROAD — ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	1	15%	0.0	0.2
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	1	50%	0.0	0.5
SINGLE VEHICLE	1	4	60%	0.6	2.4
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	3	15%	0.0	0.5
TOTALS :	1	9	***	0.6	3.5

% REDUCTION IN INJURY/FATAL ACCIDENTS = 60.0%
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS = 38.9%

PATCH POTHOLES ALONG ENTIRE LENGTH



McCLELLAN ROAD — COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	4	Ea	$100.00	$400.00
2	NEW SIGNS (6.1 TO 10 SF)	6	Ea	$140.00	$840.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	4	Ea	$50.00	$200.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	1	Ea	$20.00	$20.00
7	PAVE. MARKINGS (PAINT)	70	Gal	$30.00	$2,100.00
8	PAVE. MARKING PLASTIC	0	SF	$6.00	$0.00
9	DELINEATORS, FLEXIBLE	60	Ea	$20.00	$1,200.00
10	TRIM TREES	0	LS	$0.00	$0.00
11	APPROACH WORK	1	LS	$200.00	$200.00

TOTAL CONSTRUCTION COSTS = $4,960.00

DATE:

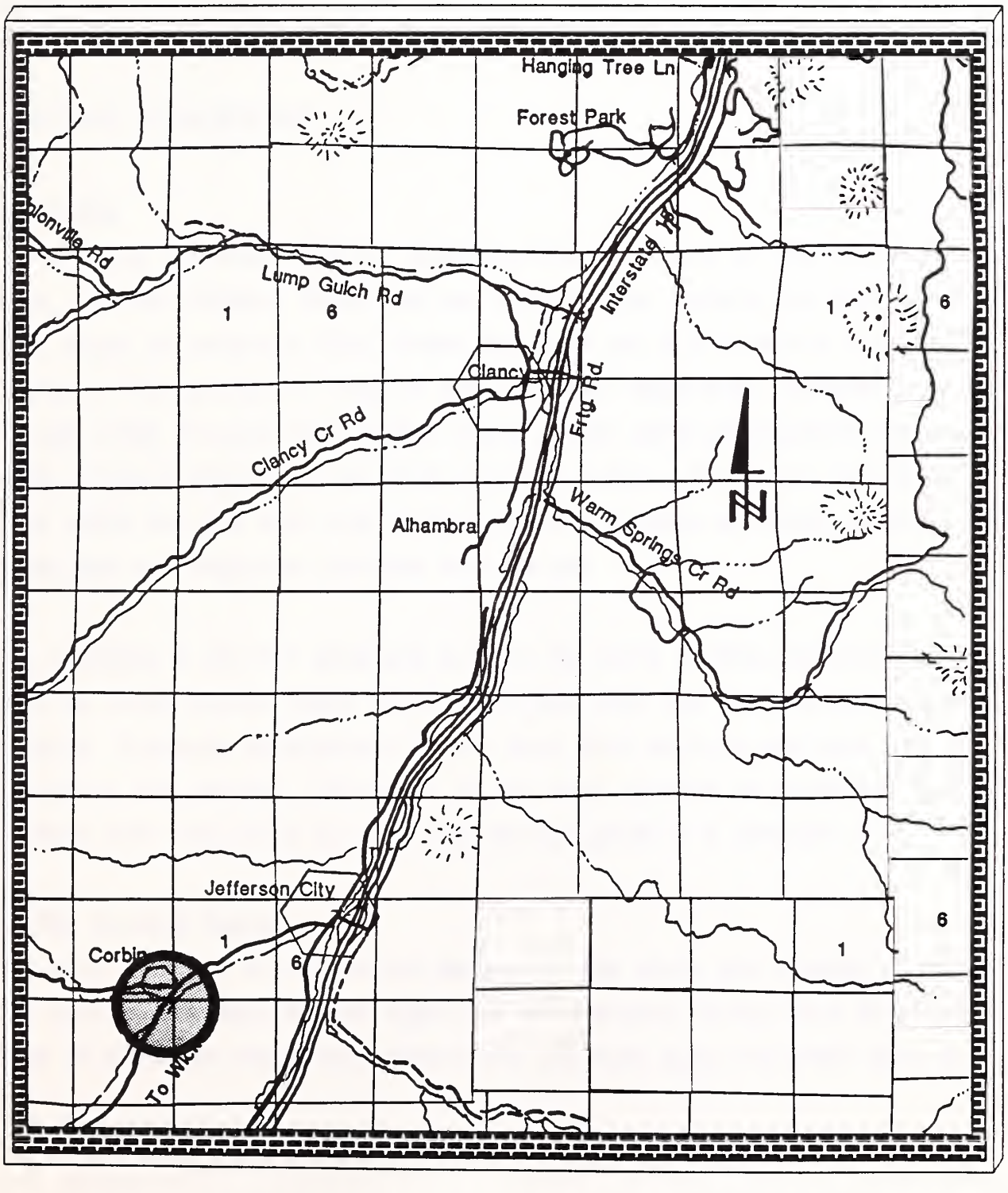
MARVIN & ASSOCIATES
Traffic, Transportation & Civil Engineers
1127 Alderson Ave.
Suite 204
Billings, MT 59102
(406) 248-5033

SHORT TERM IMPROVEMENTS

McCLELLAN CREEK ROAD

FIGURE NO.

CORBIN - WICKES ROAD
PRIORITY # 10



CORBIN - WICKES ROAD

PRIORITY NUMBER 10

SITE DESCRIPTION

Corbin -Wickes Road is a rural road which provides access to the small communities of Corbin and Wickes and most recently the Pegusus Gold Mine. Corbin is located approximately 1.5 miles west of Jefferson City at Interstate 15 and Wickes is located approximately 2 miles southwest of Corbin. The cluster site is located within the immediate area of Corbin.

EXISTING CONDITIONS

Geometry

The existing condition sketch illustrates the geometry of the accident site area. Corbin -Wickes Road has an asphalt type surface for the first two miles south of Jefferson City. From that point on, it is a gravel road toward Wickes. The section of road in this site was apparently realigned and improved within the past four to five years. Older aerial photographs indicate a much different alignment than what currently exists. There are two intersections within the site and both of them provide access to Corbin at the point where the new alignment deviates from the old.

The roadway is 23 feet wide and exhibits the same spalling and potholed surface as other county roads which were built with the thin asphaltic layer of material. Roadside environment include short ditch sections and new fencing throughout the section. Alignment of the road consists of extended tangent sections with very short curves. The vertical grade is a constant 3 %.

Traffic Control Devices

Currently, standard traffic control devices at the study site consist of numerous "School Bus Stop Ahead" signs and non-standard "School Bus Stop" signs, none of which are warranted. Speed limit (35 mph) signs and yield signs at

the road approaches are the only other standard signs at the site. A directional sign for the gold mine also exists.

Traffic Volumes

Approximate ADT (Average Daily Traffic) on Corbin -Wickes Creek Road is 500. Traffic volumes throughout the five year accident period have probably increased somewhat due to mining activity. Peak hour volumes are consistent with typical hourly variations in Jefferson County and are approximately 12 to 14% of ADT.

Traffic Operations

The paved surface and extended tangent sections on this road encourage drivers to go faster than the posted speed limit. All of the curves ballbank faster than the 35 mph speed limit and from observations, vehicles travel in the 45 mph range.

The presence of all the school bus warning signs is the most noticeable feature of the site. Overkill with unwarranted signs not only fosters disrespect for other critical signs, but in this case, they are almost distracting from the normal view of the road and road conditions.

Accidents

An accident statistics table and collision diagrametrics are plotted on the existing condition sketch. There were 3 accidents reported at this site during the 5 year period. Two accident reports were eliminated because they had obviously occurred on the old roadway alignment. Two of the accidents were single vehicle accidents with fixed objects and one was a single vehicle off road accident. All of the accidents occurred on dry road surfaces. None of the accidents produced injuries. The accident rate at night was much greater than the daytime accident rate.

SHORT TERM IMPROVEMENTS

Suggested improvements at this site are made in an effort to reduce problems identified with traffic control devices and to provide positive guidance through this area. The school warning signs are completely unwarranted and should be removed. In this case it would be very easy for the school bus to drive into Corbin and drive out through the loop created by the old road alignment if necessary.

Continuous delineation through this area will help define the roadway alignment especially through the short curves at night.

The intersecting roads are at such an angle that drivers could not enter the roadway on a right turn at a minimum speed of 15 mph. Therefore, yield signs are not warranted and stop signs should replace them.

Hazard markers should be placed at the ends of the culverts because of the abrupt edges and steep drop.

Costs associated with above noted improvements are estimated to be $1,480.00. Most of which would be fundable through MDOH Off-system safety funds.

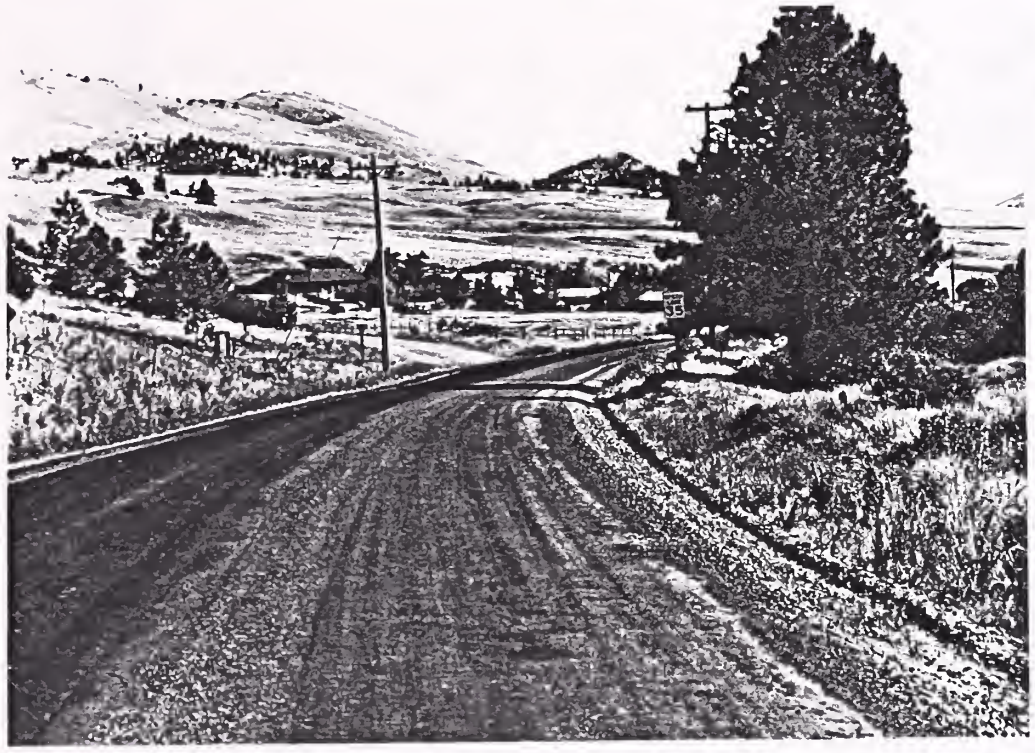
Long term improvements at this site cannot be foreseen at this time.

BENEFITS

Accident reduction at this site could be as high as 60 %, if the improvements were implemented. Annual economic savings, in terms of accident reduction could only reach $ 551.00, but the computed benefit/cost ratio would still be 1.25 a rate of return sufficient for the investment.

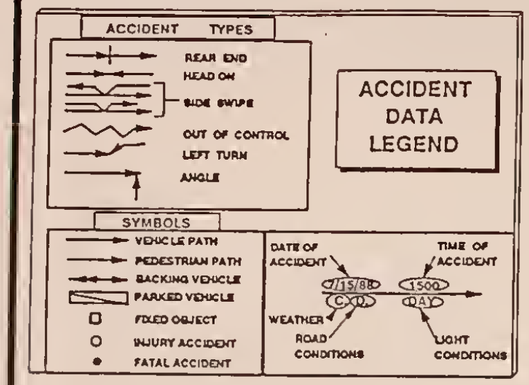
CORBIN - WICKES RD - LOOKING N.E. NORTH END

CORBIN - WICKES RD - LOOKING S.W. NORTH END



CORBIN - WICKES RD - LOOKING N.E. SOUTH END

CORBIN - WICKES RD - LOOKING S.W. SOUTH END



ACCIDENT STATISTICS
CORBIN-WICKES ROAD

	85	86	87	88	89	TOTAL
# ACCIDENTS IN YEAR			1	1	1	3

	OFF RD.	ANG	HEAD ON	SIDE SWP	REAR END	OTHER
ACCIDENT TYPE	1					2

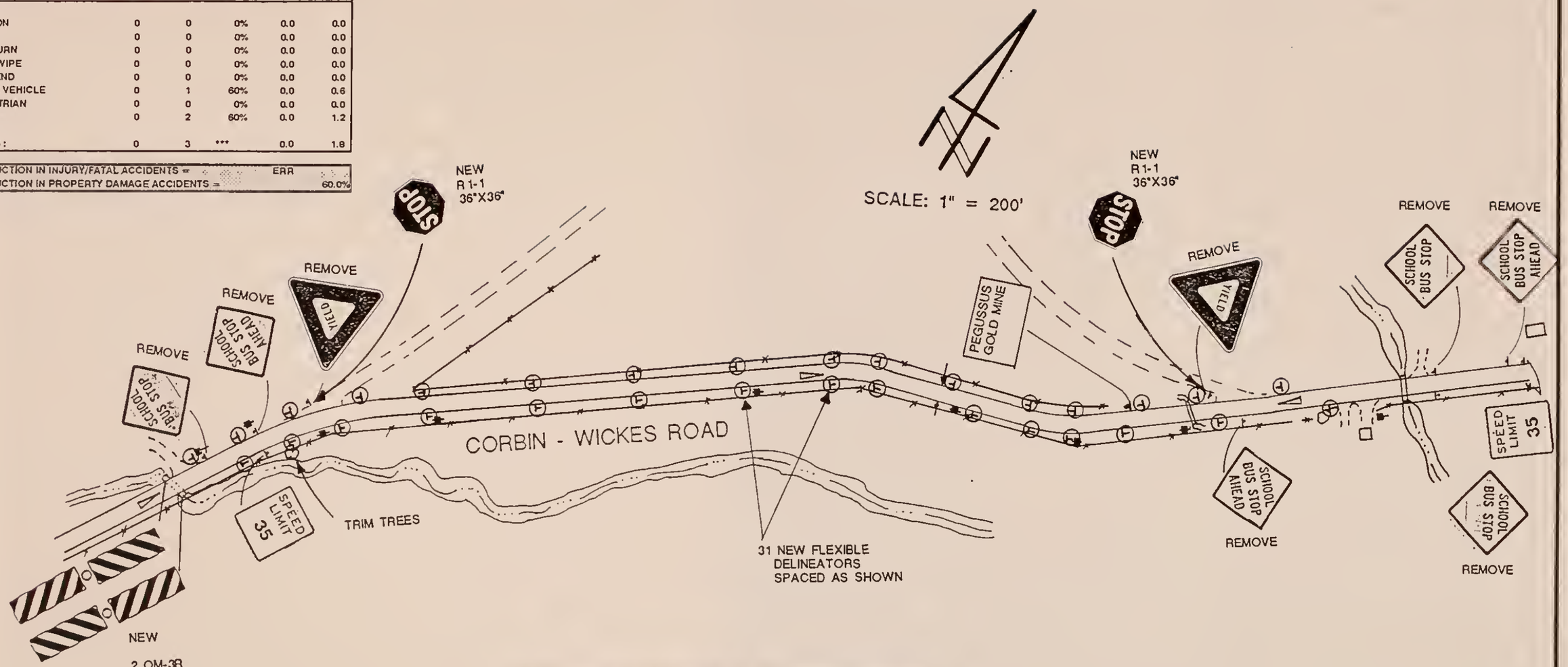
	C	CL	R	S	F
WEATHER	3				
	D	W	I	S	
ROAD CONDITION	3				
	DAY		NITE		
LIGHT CONDITION	1		2		
	PDO		INJ		FATA
SEVERITY	3		0		
		YES		NO	
ALCOHOL INVOLVED		1		2	

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	EXISTING CONDITIONS	CORBIN - WICKES ROAD	FIGURE NO.

CORBIN - WICKES ROAD ACCIDENT REDUCTION ESTIMATE

ACCIDENT TYPE	# ACC. IN PERIOD I/F	# ACC. IN PERIOD PD	EST. % CHANGE	CHANGE IN # ACC. I/F	CHANGE IN # ACC. PD
HEAD ON	0	0	0%	0.0	0.0
ANGLE	0	0	0%	0.0	0.0
LEFT TURN	0	0	0%	0.0	0.0
SIDE SWIPE	0	0	0%	0.0	0.0
REAR END	0	0	0%	0.0	0.0
SINGLE VEHICLE	0	1	60%	0.0	0.6
PEDESTRIAN	0	0	0%	0.0	0.0
OTHER	0	2	60%	0.0	1.2
TOTALS :	0	3	***	0.0	1.8

% REDUCTION IN INJURY/FATAL ACCIDENTS =	ERR
% REDUCTION IN PROPERTY DAMAGE ACCIDENTS =	60.0%



CORBIN-WICKES ROAD COST ESTIMATE

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	NEW SIGNS (<6 SF)	4	Ea	$100.00	$400.00
2	NEW SIGNS (6.1 TO 10 SF)	2	Ea	$140.00	$280.00
3	NEW SIGNS (10.1 TO 20 SF)	0	Ea	$170.00	$0.00
4	NEW SUPPLEMENTARY SIGN	0	Ea	$50.00	$0.00
5	RELOCATE SIGNS	0	Ea	$40.00	$0.00
6	REMOVE SIGNS	8	Ea	$20.00	$160.00
7	PAVE. MARKINGS (PAINT)	0	Gal	$30.00	$0.00
8	PAVE. MARKING PLASTIC	0	SF	$6.00	$0.00
9	DELINEATORS, FLEXIBLE	31	Ea	$20.00	$620.00
10	TRIM TREES	1	LS	$20.00	$20.00
11	APPROACH WORK	0	LS	$0.00	$0.00

TOTAL CONSTRUCTION COSTS =	$1,480.00

DATE:	MARVIN & ASSOCIATES Traffic, Transportation & Civil Engineers	1127 Alderson Ave Suite 204 Billings, MT 59102 (406) 248-5033	SHORT TERM IMPROVEMENTS	CORBIN - WICKES ROAD FIGURE NO.